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General Aptitude Section

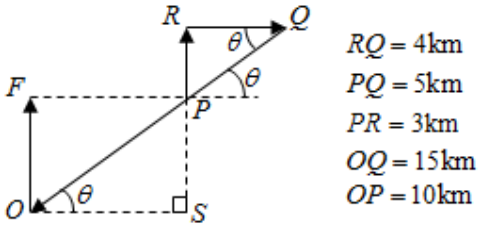
GATE – 2017 (General Aptitude Section)

Note: The following question came in GATE – 2017 in Aptitude Section. You are advised to go through first these questions, so that you can know your knowledge. In case you find any difficulty it is advised to go through carefully the concepts given in the chapter so that in GATE – 2018 examination you can tackle any question without any difficulty.

[GA – 2017 (1 mark)]: The ninth and the tenth of this month are Monday and Tuesday _____.
(a) figuratively (b) retrospectively (c) respectively (d) rightfully
Solution (c): Respectively is used to indicate order with reference to two or more things previously mentioned.

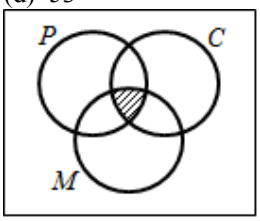
[GA – 2017 (1 mark)]: It is _____ to read this year's textbook _____ the last year's.
(a) easier, than (b) most easy, than (c) easier, from (d) easiest, from
Solution (a): Easiest, which is an adjective, is superlative of easy; but Easier, which is an adjective, is comparative of easy. So 'easier' is used. The word 'from' is used with the source; but the word 'than' is used for comparison, and is associated with comparatives. So 'than' is used.

[GA – 2017 (1 mark)]: Fatima starts from point P, goes North for 3 km, and then East for 4 km to reach point Q. She then turns to face P and goes 15 km in that direction. She then goes North for 6 km. How far is she from point P, and in which direction should she go to reach point P?
(a) 8 km, East (b) 12 km, North (c) 6 km, East (d) 10 km, North
Solution: From the diagram, $\tan\theta = PR/RQ = 3/4$. As $OP = 10\text{km}$, so $PS = OP\sin\theta = 10\times(3/5) = 6\text{km} = OF$; and $OS = OP\cos\theta = 10\times(4/5) = 8\text{km} = FP$. So $OF \perp FP$. Thus $FP = \sqrt{OP^2 - OF^2} = \sqrt{10^2 - 6^2} = 8$ km. From the diagram she should approach towards East direction for 8 km in order to reach point P.



[AE, EC, MA, MT, PE, PH – 2017 (1 mark)]: 500 students are taking one or more courses out of Chemistry, Physics, and Mathematics. Registration records indicate course enrolment as follows: Chemistry (329), Physics (186), Mathematics (295), Chemistry and Physics (83), Chemistry and Mathematics (217), and Physics and Mathematics (63). How many students are taking all 3 subjects?
(a) 37 (b) 43 (c) 47 (d) 53
Solution: We have to find the number of student lie in the shaded region, which is $n(P\cap C\cap M)$. We know that

$$n(P\cup C\cup M) = n(P)+n(C)+n(M) - n(P\cap C) - n(C\cap M) - n(M\cap P) + n(P\cap C\cap M)$$



As $n(P\cup C\cup M) = 500$; $n(P) = 186$; $n(C) = 329$; $n(M) = 295$; $n(P\cap C) = 83$; $n(C\cap M) = 217$; $n(M\cap P) = 63$. So

$$500 = 186+329+295-83-217-63+n(P\cap C\cap M)$$
$$\Rightarrow n(P\cap C\cap M) = 53$$

[GA – 2017 (1 mark)]: A rule states that in order to drink beer, one must be over 18 years old. In a bar, there are 4 people. P is 16 years old, Q is 25 years old. R is drinking milkshake and S is drinking a beer. What must be checked to ensure that the rule is being followed?
(a) Only P's drink (b) Only P's drink and S's age
(c) Only S's age (d) Only P's drink, Q's drink and S's age
Solution (b): The rule is violated if anyone who is below 18 years, drinking beer. As P is 16 year old, so he can drink beer; thus we need to check P's drink. Q is 25 years old, so Q can drink beer. R is not drinking beer, so no need to check his age. Since S is drinking beer, so his age must be checked. Thus for the rule to be followed, we need to check P's drink and S's age.

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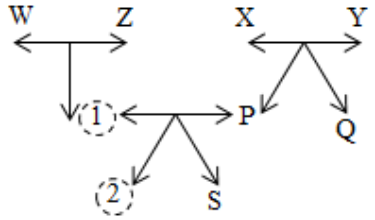
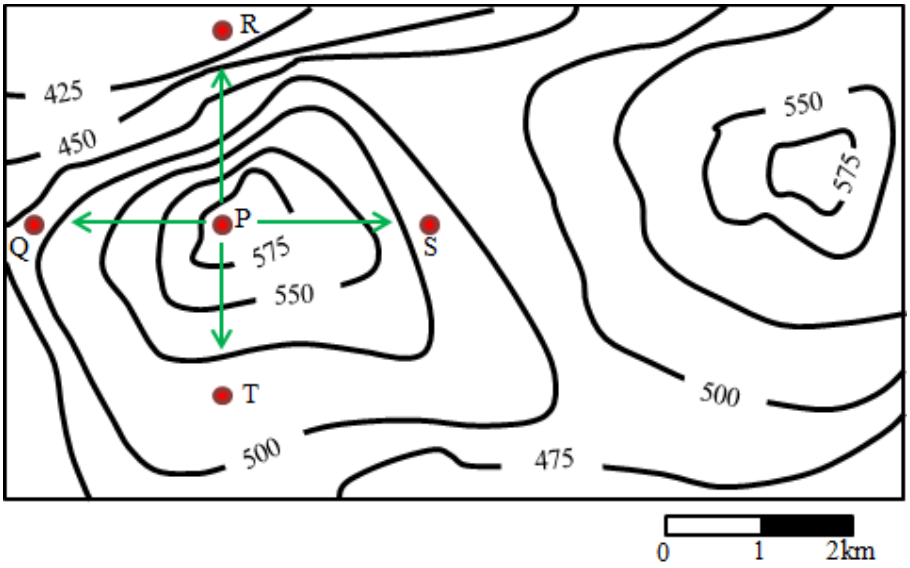
[GA – 2017 (2 marks)]: "If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for the reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective sections, and ultimately on Asia, you will not find it in these pages; for though I have spent a lifetime in the country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters."
Which of the following statements best reflects the author's opinion?
(a) An intimate association does not allow for the necessary perspective.
(b) Matters are recorded with an impartial perspective.
(c) An intimate association offers an impartial perspective.
(d) Actors are typically associated with the impartial recording of matters.
Solution (a): The sentence 'I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters', suggests option (a) is best reflected by the author's opinion.

[GA – 2017 (2 marks)]: Each of P, Q, R, S, W, X, Y and Z has been married at most once. X and Y are married and have two children P and Q. Z is the grandfather of the daughter S of P. Further, Z and W are married and are parents of R. Which one of the following must necessarily be FALSE?
(a) X is the mother-in-law of R (b) P and R are not married to each other
(c) P is a son of X and Y (d) Q cannot be married to R
Solution (d): The situation is described in figure shown. If position of R is at 1, then options (a) and (c) are possible; if position of R is at 2, then option (b) is possible. Now the statement 'Z is the grandfather of the daughter S of P'; so if R is married to Q then it can possible that W and Z have another son who is married to P. So it can be possible that R and Q can be married.



[GA – 2017 (2 marks)]: A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot. Which of the following is the steepest path leaving from P?



(a) P to Q (b) P to R (c) P to S (d) P to T
Solution (b): The steepest path will be that path which is deepest from sea level. So P to R is the steepest path.

[GA – 2017 (2 marks)]: 1200 men and 500 women can build a bridge in 2 weeks. 900 men and 250 women will take 3 weeks to build the same bridge. How many men will be needed to build the bridge in one week?
(a) 3000 (b) 3300 (c) 3600 (d) 3900

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Solution (c): In 2 weeks, 1200 men + 500 women can build a bridge $\Rightarrow$ in 1 week, 1200×2 men + 500×2 women can build a bridge; i.e. in 1 week, 2400 men + 1000 women can build a bridge. Similarly, in 3 weeks, 900 men + 250 women can build a bridge $\Rightarrow$ in 1 week, 900×3 men + 250×3 women can build a bridge; i.e. in 1 week, 2700 men + 750 women can build a bridge.
So in a week, the bridge can be built by either (2400 men + 1000 women) or (2700 men + 750 women), i.e. (2400 men + 1000 women) = (2700 men + 750 women) $\Rightarrow 1$ women $= (6/5)$ men .
Thus number of men required to build a bridge in one week is $2400+1000(6/5)=3600$ men.

[GA – 2017 (2 marks)]: The number of 3-digit numbers such that digit 1 is never to the immediate right of 2 is
(a) 781 (b) 791 (c) 881 (d) 891
Solution (c): Total number of 3 digit numbers are: $\boxed{9}\ \boxed{10}\ \boxed{10}=9\times 10\times 10=900$.
Now total number of 3 digit numbers such that digit 1 is to the immediate right of 2 is: $\boxed{x}\ \boxed{2}\ \boxed{1}$ or $\boxed{2}\ \boxed{1}\ \boxed{x}$ $\Rightarrow$ $\underbrace{\boxed{9}\ \boxed{1}\ \boxed{1}}_{\text{number of choices}}$ or $\underbrace{\boxed{1}\ \boxed{1}\ \boxed{10}}_{\text{number of choices}}$ $=9\times 1\times 1+1\times 1\times 10=19$ numbers.
Thus required number of 3 digit numbers such that 1 is never to the immediate right of 2 is given by: $900-19=881$.

[GA – 2017 (1 mark)]: The ways in which this game can be played _____ potentially infinite.
(a) Is (b) is being (c) are (d) are being
Solution (c): As '**ways**' is plural so we have to use 'are'. The ways in which this game can be played **are** potentially infinite.

[GA – 2017 (1 mark)]: If you choose plan P, you will have to _____ plan Q, as these two are mutually _____.
(a) forgo, exclusive (b) forget, inclusive (c) accept, exhaustive (d) adopt, intrusive
Solution (a): 'Forgo' means 'to go without something which is desirable; 'Forget' means 'fail to remember'; 'Accept' means 'consent to receive or undertake'; 'Adopt' means 'choosing to take up something'. 'Exclusive' means 'excluding something'; 'Inclusive' means 'including something'; 'Exhaustive' means 'including or considering all elements or aspects'; 'Intrusive' means 'causing disruption'. So the correct set of words used in given sentence is given by option (a).

[GA – 2017 (1 mark)]: If a and b are integers and $a-b$ is even, which of the following must always be even?
(a) ab (b) a^2+b^2+1 (c) a^2+b+1 (d) $ab-b$
Solution (d): The possibilities are given in following table:
It is assumed that $\text{Even}\pm\text{Even}=\text{Even}$; $\text{Odd}\pm\text{Odd}=\text{Even}$; $\text{Even}\pm\text{Odd}=\text{Odd}$; $\text{Even}\times\text{Odd}=\text{Even}$; $\text{Even}\times\text{Even}=\text{Even}$; $\text{Odd}\times\text{Odd}=\text{Odd}$. So

a	b	ab	a^2	b^2	a^2+b^2+1	a^2+b+1	$ab-b$
Odd	Odd	Odd	Odd	Odd	Odd	Odd	Even
Even	Even	Even	Even	Even	Odd	Odd	Even

Hence option (d) is correct.

[GA – 2017 (1 mark)]: A couple has 2 children. The probability that both children are boys if the older one is a boy is
(a) $1/4$ (b) $1/3$ (c) $1/2$ (d) 1
Solution (c): Let 'B' and 'G' be the boy and the girl. So the possible elements in the set which contains the two children is given by $\{(B,B),(B,G),(G,B),(G,G)\}$, where the first element of ordered pair (a,b) is a, who is older than b. So possible cases according to question is $\{(B,B),(B,G)\}$; and favourable case is $\{(B,B)\}$.

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So required probability is given by $\frac{\text{number of favourable cases}}{\text{number of possible cases}} = \frac{1}{2}$.

[GA – 2017 (1 mark)]: P looks at Q while Q at R. P is married, R is not. The number of pairs of people in which a married person is looking at an unmarried person is
(a) 0 (b) 1 (c) 2 (d) Cannot be determined
Solution (b): If Q is married, then P (married) looks at Q (married) while Q (married) at R (unmarried); so in this case Q (married person) is looking at an R (unmarried person), thus required number of pair of people is 1.
If Q is unmarried, then P (married) looks at Q (unmarried) while Q at R (unmarried); so in this case P (married person) is looking at an Q (unmarried person), thus required number of pair of people is 1.
In both cases the required number of pairs of people is 1.

[GA – 2017 (2 marks)]: "If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for the reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective sections, and ultimately on Asia, you will not find it in these pages; for though I have spent a lifetime in the country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters."
Which of the following is closest in meaning to 'cleaving'?
(a) deteriorating (b) arguing (c) departing (d) splitting
Solution: Cleaving means to split something along a natural line.
Deteriorate means to become progressively worse; Argue means to express opposite views, typically in angry way; Depart means to leave, especially in order to start a journey; Split means cause to break forcibly into parts.
Thus 'Splitting' is the closest meaning to 'Cleaving'.

[GA – 2017 (2 marks)]: X bullocks and Y tractors take 8 days to plough a field. If we halve the number of bullocks and double the number of tractors, it takes 5 days to plough the same field. How many days will it take X bullocks alone to plough the field?
(a) 30 (b) 35 (c) 40 (d) 45
Solution (a): Let $b = \text{bullocks}$ and $t = \text{tractors}$. In 8 days, $Xb + Yt$ can plough a field; so in 1 day, $8Xb + 8Yt$ can plough a field. Also in 5 days, $(X/2)b + (2Y)t$ can plough a field; so in 1 day, $(5X/2)b + (10Y)t$. Thus $8Xb + 8Yt = (5X/2)b + (10Y)t \Rightarrow (11X/4Y)b = t$.
Hence it can be concluded that in 1 day, the field can be plough by $(5X/2)b + (10Y)t = (5X/2)b + (10Y)(11X/4Y)b = (30X)b$ or $(X)b$ can plough field in $30 \times 1 = 30$ days.

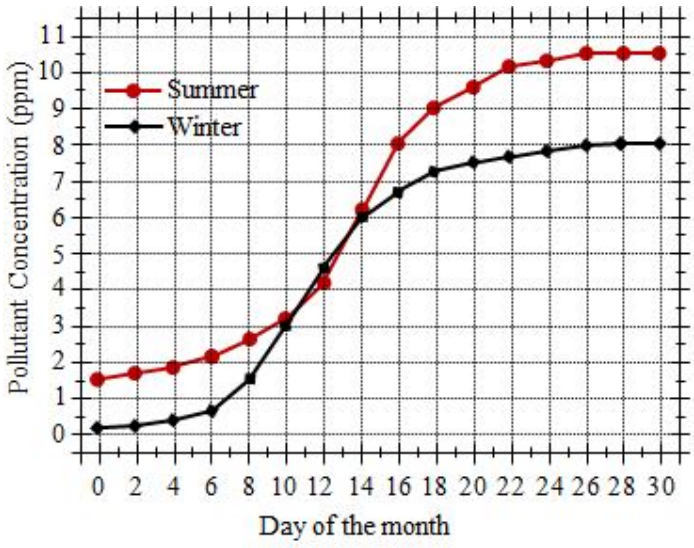
[GA – 2017 (2 marks)]: There are 4 women P, Q, R, S, and 5 men V, W, X, Y, Z in a group. We are required to form pairs each consisting of one woman and one man. P is not to be paired with Z, and Y must necessarily be paired with someone. In how many ways can 4 such pairs be formed?
(a) 74 (b) 76 (c) 78 (d) 80
Solution (c): Case I: If P is paired with Y, then Q, R and S has 4, 3, 2 choices, respectively; so total number of choices are $4 \times 3 \times 2 = 24$ choices.
Case II: If Q is paired with Y, then P, R and S has 3, 3, 2 choices, respectively; so total number of choices are $3 \times 3 \times 2 = 18$ choices.
Case III: If R is paired with Y, then P, Q and S has 3, 3, 2 choices, respectively; so total number of choices are $3 \times 3 \times 2 = 18$ choices.
Case IV: If S is paired with Y, then P, Q and R has 3, 3, 2 choices, respectively; so total number of choices are $3 \times 3 \times 2 = 18$ choices.
So we have either case I or II or III or IV; so total number of choices $= 24 + 18 + 18 + 18 = 78$.
[GA – 2017 (2 marks)]: All people in a certain island are either 'Knights' or 'Knaves' and each person knows every other person's identity. Knights NEVER lie, and Knaves always lie. P says "Both

of us are knights". Q says "None of us are knaves". Which one of the following can be logically inferred from the above?

(a) Both P and Q are knights (b) P is knight; Q is knave
(c) Both P and Q are knaves (d) The identities of P, Q cannot be determined

Solution (d): If P is Knight, then "Both of us are Knights" $\Rightarrow$ P and Q both are Knights.
If P is Knave, then P always lies, so according to P, both of them are not Knights, i.e. it can possible that (P, Q) are (Knight, Knave) or (Knave, Knight) or (Knave, Knave).
If Q is Knight, then "None of us are Knaves" $\Rightarrow$ P and Q both are Knights.
If Q is Knave, then Q always lies, so it can possible that (P, Q) are (Knight, Knave) or (Knave, Knight) or (Knight, Knight).
Thus all (a), (b) and (c) are possible identities of P and Q; and with the given information, we cannot conclude the exact identity of P and Q. Thus option (d) is correct.

[GA – 2017 (2 marks)]: In the graph below, the concentration of a particular pollutant in a lake is plotted over (alternate) days of a month in winter (average temperature 10°C) and a month in summer (average temperature 30°C).



Consider the following statements based on the data shown above:

(i) Over the given months, the difference between the maximum and minimum pollutant concentrations is the same in both winter and summer.
(ii) There are at least four days in the summer month such that the pollutant concentrations on those days are within 1 ppm of the pollutant concentrations on the corresponding days in the winter months

Which one of the following options is correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

Solution (b): In winter, the maximum pollutant concentration is 8 ppm and minimum pollutant concentration is 0.1 ppm; so the required difference is $= 8 - 0.1 = 7.9$ ppm. In summer, the maximum pollutant concentration is 10.5 ppm and minimum pollutant concentration is 1.5 ppm; so the required difference is $= 10.5 - 1.5 = 9$ ppm. So statement (i) is not correct.
Statement (ii) is correct, which is clearly interpreted from graph.

[GA – 2017 (1 mark)]: He was one of my best _____ and I felt his loss _____.

(a) friend, keenly (b) friends, keen (c) friend, keener (d) friends, keenly

Solution (d): The phrase "one of" implies that we are describing a single (singular) thing out of many (plural) things. So 'friends' should be used and thus options (a) and (c) are not correct. As keenly is a derived term of keen; as an adverb keenly is in a keen manner. Thus keenly should be used. Hence option (d) is correct.

[GA – 2017 (1 mark)]: As the two speakers became increasingly agitated, the debate became _____.

(a) lukewarm (b) poetic (c) forgiving (d) heated

Solution (d): Agitated means 'feeling trouble or nervous'. As options (a), (b) and (c) are not suitable word for the result in debate. So option (d) is correct.

[GA – 2017 (1 mark)]: In a company with 100 employees, 45 earn Rs. 20,000 per month, 25 earn Rs. 30,000, 20 earn Rs. 40,000, 8 earn Rs. 60,000, and 2 earn Rs. 150,000. The median of the salaries is

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(a) Rs. 20,000 (b) Rs. 30,000 (c) Rs. 32,300 (d) Rs. 40,000

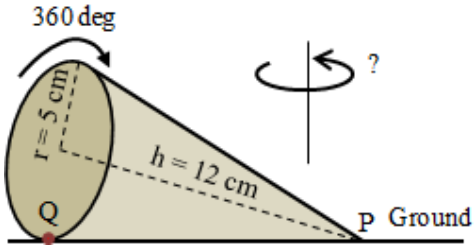
Solution (b): Writing all the values in ascending order: Rs. 20,000, ⋯, (45 times), 30,000, ⋯, (25 times), 40,000, ⋯, (20 times), 60,000, ⋯, (8 times), 150,000, 150,000.

Thus total number of observations are 100, which is even. So median is the average of $(100/2)^{th}$ and $\{(100/2)+1\}^{th}$ observation; i.e. average of 50^{th} and 51^{st} observation.

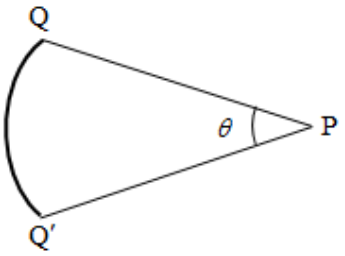
As 50^{th} observation = Rs. 30,000 and 51^{st} observation = Rs. 30,000, so median of the salaries is $= \dfrac{30,000+30,000}{2} = \text{Rs. } 30,000.$

[GA – 2017 (1 mark)]: A right-angled cone (with base radius 5 cm and height 12 cm), as shown in the figure below, is rolled on the ground keeping the point P fixed until the point Q (at the base of the cone, as shown) touches the ground again. By what angle (in radians) about P does the cone travel?

(a) $5\pi/12$ (b) $5\pi/24$ (c) $24\pi/5$ (d) $10\pi/13$



Solution (d): As shown in figure, after rolled through 360^o, point Q again meets the ground at Q'.



As $PQ = PQ' = \sqrt{h^2+r^2} = \sqrt{12^2+5^2} = 13\,\text{cm}.$

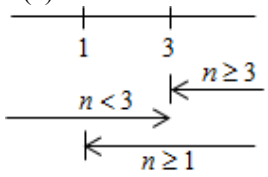
Also arc $QQ' = 2\pi r = 2\pi \times 5 = 10\pi$ cm

So $\theta = \dfrac{\text{arc}(QQ')}{PQ} = \dfrac{10\pi}{13}.$

[GA – 2017 (1 mark)]: P, Q, and R talk about S's car collection. P states that S has at least 3 cars. Q believes that S has less than 3 cars. R indicates that to his knowledge, S has at least one car. Only one of P, Q and R is right. The number of cars owned by S is

(a) 0 (b) 1 (c) 3 (d) Cannot be determined

Solution (a): If only one of them is correct, then we have to choose that interval in which two or more conditions not lying. If $n = 1$ or 2, then S and R are correct. If $n = 3$ or more then P and R both are correct. So n must be 0, as for $n = 0$ only Q is correct.



[GA – 2017 (2 marks)]: "Here, throughout the early 1820s, Stuart continued to fight his losing battle to allow his sepoys to wear their caste-marks and their own choice of facial hair on parade, being again reprimanded by the commander-in-chief. His retort that 'A stronger instance than this of European prejudice with relation to this country has never come under my observations' had no effect on his superiors."

According to this paragraph, which of the statements below is most accurate?

(a) Stuart's commander-in-chief was moved by this demonstration of his prejudice.
(b) The Europeans were accommodating of the sepoys' desire to wear their caste-marks.
(c) Stuart's 'losing battle' refers to his inability to succeed in enabling sepoys to wear caste-marks.
(d) The commander-in-chief was exempt from the European prejudice that dictated how the sepoys were to dress.

Solution (c): Stuart continued to fight his losing battle to allow his sepoys to wear their caste-marks and their own choice of facial hair on parade, being again reprimanded by the commander-in-chief. The above sentence leads to option (c).

[GA – 2017 (2 marks)]: Two very famous sportsmen Mark and Steve happened to be brothers, and played for country K. Mark teased James, an opponent from country E, "There is no way

you are good enough to play for your country." James replied, "Maybe not, but at least I am the best player in my own family."

Which one of the following can be inferred from this conversation?

(a) Mark was known to play better than James (b) Steve was known to play better than Mark

(c) James and Steve were good friends (d) James played better than Steve

Solution (b): It is crystal clear from James reply that everyone knows that among two brothers (Mark and Steve, who are family members), Steve is playing better than Mark. So option (b) is correct.

[GA – 2017 (2 marks)]: What is the sum of the missing digits in the subtraction problem below?

$$\begin{array}{r} 5\ \_\ \_\ \_\ \_ \\ -\ 4\ 8\ \_\ 8\ 9 \\ \hline 1\ 1\ 1\ 1 \end{array}$$

(a) 8

(b) 10

(c) 11

(d) Cannot be determined

Solution: Let our subtraction be given by. So $5pqrs = 48x89 + 01111$

$$\begin{array}{r} 5\ p\ q\ r\ s \\ -\ 4\ 8\ x\ 8\ 9 \\ \hline 1\ 1\ 1\ 1 \end{array}$$

So above sum is possible if $x = 8$ or $x = 9$.

For $x = 8$, $50000 = 48889 + 01111$, thus $p = q = r = s = 0$; so sum of missing digits is 8.

For $x = 9$, $50100 = 48989 + 01111$, thus $p = r = s = 0$, $q = 1$; so sum of missing digits is 10.

So with the give data, we can have the possible solution, but we cannot get exact solution. So option (d) is correct.

[GA – 2017 (2 marks)]: Let S_1 be the plane figure consisting of the points (x, y) given by the inequalities $|x-1| \le 2$ and $|y+2| \le 3$. Let S_2 be the plane figure given by the inequalities $x - y \ge -2$, $y \ge 1$, and $x \le 3$. Let S be the union of S_1 and S_2. The area of S is

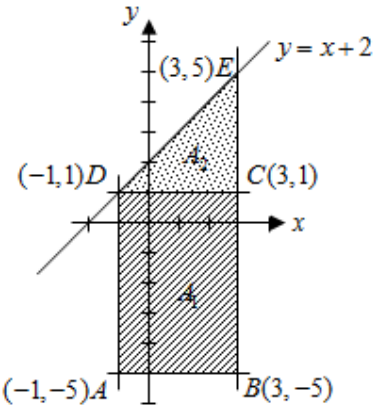
(a) 26 (b) 28

(c) 32 (d) 34

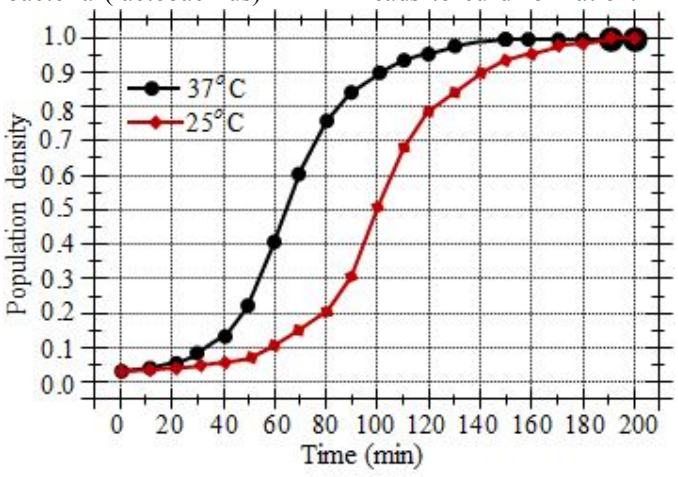
Solution (c): For S_1, $|x-1| \le 2$ $\Rightarrow -2 \le x-1 \le 2 \Rightarrow -1 \le x \le 3$. Also $|y+2| \le 3 \Rightarrow -3 \le y+2 \le 3$ $\Rightarrow -5 \le y \le 1$. So S_1 is a square given by $-1 \le x \le 3$ and $-5 \le y \le 1$, whose area is $A_1 = \{3-(-1)\} \times \{1-(-5)\} = 24$, as shown in figure.

S_2 is given by: $x - y \ge -2 \Rightarrow y \le x + 2$, $y \ge 1$ and $x \le 3$, which is a triangle, whose area $A_2 = (1/2)\{3-(-1)\} \times \{5-1\} = 8$.

So if S be the union of S_1 and S_2, then area of S is $A_1 + A_2 = 24 + 8 = 32$.



[GA – 2017 (2 marks)]: The growth of bacteria (lactobacillus) in milk leads to curd formation. A minimum bacterial population density of 0.8 (in suitable units) is needed to form curd. In the graph below, the population density of lactobacillus in 1 litre of milk is plotted as a function of time, at two different temperatures, 25°C and 37°C.



Consider the following statements based on the data shown above:

(i) The growth in bacterial population stops earlier at 37°C as compared to 25°C

(ii) The time taken for curd formation at 25°C is twice the time taken at 37°C

Which one of the following options is correct?

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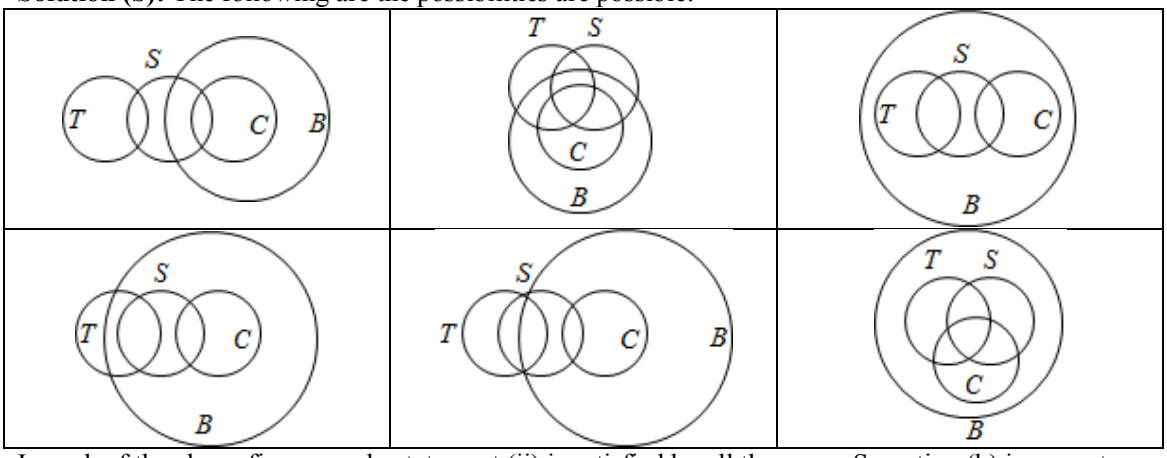
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)
Solution (a): From the graph, it is clear that statement (i) is correct. Also a minimum bacterial population density of 0.8 (in suitable units) is needed to form curd. At 25°C, the required populations is achieved after approximately 120 minutes; but at 37°C, this time is approximately 85 minutes. So statement (ii) is not correct.

[GA – 2017 (1 mark)]: She has a sharp tongue and it can occasionally turn _____.
(a) hurtful (b) left (c) methodical (d) vital
Solution (a): Sharp tongue means 'having a tendency to say very critical things to people'. Hurtful means causing injury or emotional pain, especially cruel or unkind. Methodical means doing something in a systematic manner. Vital means necessary or essential. So hurtful is the correct word.

[BT, CY, EC, EY, PI – 2017 (1 mark)]: I _____ made arrangements had I _____ informed earlier.
(a) could have, been (b) would have, being (c) had, have (d) had been, been
Solution (a): Could have + past participle means that something was possible in the past, which was not done. So option (a) is correct.

[GA – 2017 (1 mark)]: Some tables are shelves. Some shelves are chairs. All chairs are benches. Which of the following conclusions can be deduced from the preceding sentences?
(i) At least one bench is a table (ii) At least one shelf is a bench
(iii) At least one chair is a table (iv) All benches are chairs
(a) Only (i) (b) Only (ii) (c) Only (ii) and (iii) (d) Only (iv)
Solution (b): The following are the possibilities are possible:



In each of the above figures, only statement (ii) is satisfied by all the cases. So option (b) is correct.

[GA – 2017 (1 mark)]: In the summer, water consumption is known to decrease overall by 25%. A Water Board official states that in the summer household consumption decreases by 20%, while other consumption increases by 70%. Which of the following statements is correct?
(a) The ratio of household to other consumption is $8/17$
(b) The ratio of household to other consumption is $1/17$
(c) The ratio of household to other consumption is $17/8$
(d) There are errors in the official's statement.
Solution (d): Let H be house hold consumption and P is the other consumption. As per given data, we have $H \times 0.8 + P \times 1.7 = (H + P) \times 0.75 \Rightarrow 0.05H = -0.95P \Rightarrow$ the ratio is negative. Thus option (d) is correct.

[GA – 2017 (1 mark)]: 40% of deaths on city roads may be attributed to drunken driving. The number of degrees needed to represent this as a slice of a pie chart is
(a) 120 (b) 144 (c) 160 (d) 212

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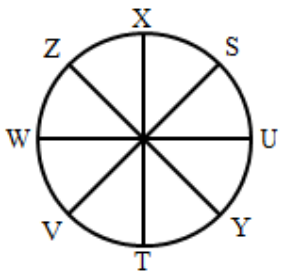
Solution (b): As 100% data is represented by 360^o. So 40% of the data is represented by the slice of a pie chart whose degree is given by $\frac{360^o}{100\%}\times 40\% = 144^o$.

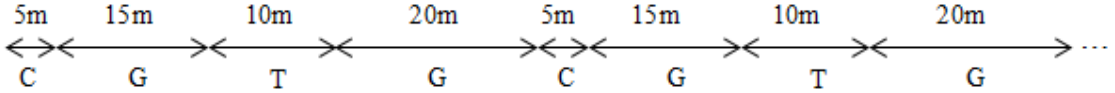
[GA – 2017 (2 marks)]: "If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for the reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective sections, and ultimately on Asia, you will not find it in these pages; for though I have spent a lifetime in the country, I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters."
Here, the word 'antagonistic' is closest in meaning to
(a) impartial (b) argumentative (c) separated (d) hostile
Solution (d): Antagonistic means 'showing or feeling active opposition or hostility towards someone or something'. Impartial means 'to treat all rivals or disputants equally'. Argumentative means 'arguing'. Hostile means 'showing or feeling opposition or dislike'. So option (d) is correct.

[GA – 2017 (2 marks)]: S, T, U, V, W, X, Y, and Z are seated around a circular table. T's neighbours are Y and V. Z is seated third to the left of T and second to right of S. U's neighbours are S and Y; and T and W are not seated opposite each other. Who is third to the left of V?
(a) X (b) W (c) U (d) T

Solution (a):
From the given conditions, only the following circular seating arrangement can be drawn. So based on the arrangement, the person on third to the left of V is X.



[GA – 2017 (2 marks)]: Trucks (10 m long) and cars (5 m long) go on a single lane bridge. There must be a gap of at least 20 m after each truck and a gap of at least 15 m after each car. Trucks and cars travel at a speed of 36 km/h. If cars and trucks go alternatively, what is the maximum number of vehicles that can use the bridge in one hour?
(a) 1440 (b) 1200 (c) 720 (d) 600
Solution (a): The situation is given in the following figure:



For maximum number of vehicles there should be exact gap of 15 m after each car and exact gap of 20 m after each truck. As speed of both car and truck is 36 km/h = 10 m/s. So in one hour or 3600 seconds, Car + Truck can cover 36000 m.
As one set of Car + Gap + Truck + Gap is of $5+15+10+20=50$ m, so there will be n set. Thus $n\times 50 = 36000 \Rightarrow n = 720$ sets, which contains $720\times 2 = 1440$ Cars + Trucks.

[GA – 2017 (2 marks)]: There are 3 Indians and 3 Chinese in a group of 6 people. How many subgroups of this group can we choose so that every subgroup has at least one Indian?
(a) 56 (b) 52 (c) 48 (d) 44
Solution: A subgroup contains one or two or maximum 6 people. So number of subgroup such that every subgroup has at least one Indian is = (number of subgroups which contains only Indians) + (number of subgroups which contains exactly one Indians and remaining Chinese) + (number of subgroups which contains exactly two Indians and remaining Chinese) + (number of subgroups which contains exactly three Indians and remaining Chinese). Thus
Number of subgroups which contains only Indians $= {}^3C_1 + {}^3C_2 + {}^3C_3 = 7$.
Number of subgroups which contains exactly one Indians and remaining Chinese $= {}^3C_1({}^3C_1 + {}^3C_2 + {}^3C_3) = 21$.

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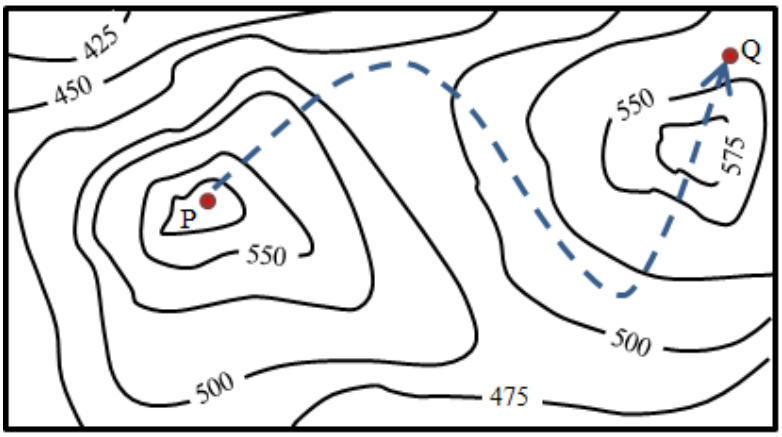
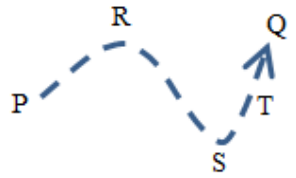
Number of subgroups which contains exactly two Indians and remaining Chinese $= {}^3C_2({}^3C_1 + {}^3C_2 + {}^3C_3) = 21$.
Number of subgroups which contains exactly three Indians and remaining Chinese $= {}^3C_3({}^3C_1 + {}^3C_2 + {}^3C_3) = 7$
So total number of subgroups is $= 7 + 21 + 21 + 7 = 56$.

[GA – 2017 (2 marks)]: A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot. The path from P to Q is best described by
(a) Up-Down-Up-Down
(b) Down-Up-Down-Up
(c) Down-Up-Down
(d) Up-Down-Up



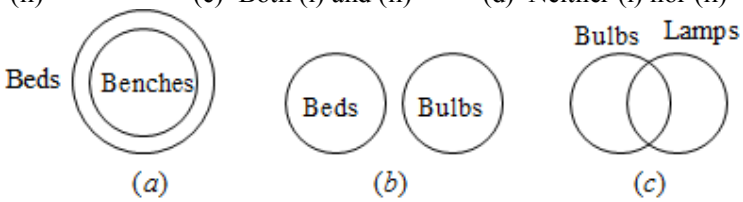
Solution (c): Based on the figure Point P is at height greater that 575 m, which is moving towards R, which is at a height between 475 m and 500 m; so **the path is going down**. Also Point R is moving towards T, which is at a height more than 575 m. It is to be noted that point R is moving towards T, via point S, which is at a height between 500 m and 525 m; so moving from R to T via S, **the path is going up**. Now point T moves towards Q, which is at a height between 525 m and 550 m, so **the path is going down**. Thus the path is **Down-Up-Down**.



[GA – 2017 (1 mark)]: The bacteria in milk are destroyed when it _____ heated to 80 degree Celsius.
(a) would be (b) will be (c) is (d) was
Solution (c): As the antecedent of 'it' is 'the milk', so option (c) is correct.

[GA – 2017 (1 mark)]: _____ with someone else's email account is now a very serious offence.
(a) Involving (b) Assisting (c) Tampering (d) Incubating
Solution (c): Involve means 'to participate in an activity or situation'. Assist means 'to help someone, typically by doing a share of the work'. Tamper means 'to interfere with something in order to cause damage or make unauthorised alterations'. Incubate means 'to cause or aid the development of an idea'. So option (c) is correct.

[GA – 2017 (1 mark)]: Consider the following sentences: **All benches are beds. No bed is a bulb. Some bulbs are lamps.** Which of the following can be inferred?
(i) Some beds are lamps (ii) Some lamps are beds
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)
Solution: As shown in figure, we do not have any direct relation between lamps and beds. So neither statement (i) nor (ii) are correct. Thus option (d) is correct.



[GA – 2017 (1 mark)]: If the radius of a right circular cone is increased by 50%, its volume increased by

(a) 75% (b) 100% (c) 125% (d) 237.5%

Solution (c): Let 'r' and 'h' be the radius and height of the cone. So $V_{initial} = (1/3)\pi r^2 h$ and $V_{final} = (1/3)\pi(3r/2)^2 h = (9/4)(1/3)\pi r^2 h = (9/4)V_{initial}$. So % increase in volume is given by $\frac{V_{final} - V_{initial}}{V_{initial}} \times 100 = \frac{(9/4) - 1}{1} \times 100 = 125\%$.

[GA – 2017 (1 mark)]: The following sequence of numbers is arranged in increasing order: 1, x, x, x, y, y, 9, 16, 18. Given that the mean and median are equal, and are also equal to twice the mode, the value of y is

(a) 5 (b) 6 (c) 7 (d) 8

Solution: The data in increasing order is: 1, x, x, x, y, y, 9, 16, 18

Mean $= \frac{3x + 2y + 44}{9}$; as median is the middle value in the list of numbers, so Median $= y$; as mode is that value which appears most often in a set of data, so Mode $= x$. Now

Mean = Median $\Rightarrow \frac{3x + 2y + 44}{9} = y \Rightarrow 3x + 44 = 7y$ …(i)

Mean = Median = Mode $\Rightarrow y = 2x$ …(ii)

From (i) and (ii), we get $x = 4$ and $y = 8$.

[GA – 2017 (2 marks)]: "The old concert hall was demolished because of fears that the foundation would be affected by the construction of the new metro line in the area. Modern technology for underground metro construction tried to mitigate the impact of pressurized air pockets created by the excavation of large amounts of soil. But even with these safeguards, it was feared that the soil below the concert hall would not be stable." From this, one can infer that

(a) the foundations of old buildings create pressurized air pockets underground, which are difficult to handle during metro construction.
(b) metro construction has to be done carefully considering its impact on the foundation of existing buildings.
(c) old buildings in an area form an impossible hurdle to metro construction in that area.
(d) pressurized air can be used to excavate large amount of soil from underground areas.

Solution (b): As mitigate means 'to make less severe', so from last two sentences of the given passage, it can be concluded that option (b) is correct.

[GA – 2017 (2 marks)]: Students applying for hostel rooms are allotted rooms in order of seniority. Students already staying in a room will move if they get a room in their preferred list. Preferences of lower ranked applicant are ignored during allocation. Given the data below, which room will Ajit stay in?

Names	Student seniority	Current room	Room preference list
Amar	1	P	R, S, Q
Akbar	2	None	R, S
Anthony	3	Q	P
Ajit	4	S	Q, P, R

(a) P (b) Q (c) R (d) S

Solution (b): As room 'R' is not occupied by anyone, so Amar will move to room 'R'. So room 'P' is vacant now, which is occupied by Anthony because Akbar has no preference. Now room 'Q' is vacant, which is occupied by Ajit. Thus room 'S' is vacant, so it is occupied by Akbar.

CE, CH, MN – 2017 (2 marks)]: The last digit of $(2171)^7 + (2172)^9 + (2173)^{11} + (2174)^{13}$ is

(a) 2 (b) 4 (c) 6 (d) 8

Solution (b): Last digit of $(2171)^7$ is 1.

As $(2172)^9 = (2172)^8 \times 2172$, so the last digit of $(2172)^9$ is (last digit of $(2172)^8$ × last digit of 2172) $= 6 \times 2 = 12$; so the last digit of $(2172)^9$ is 2.

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As $(2173)^{11} = (2173)^8 \times (2173)^3$, so the last digit of $(2173)^{11}$ is (last digit of $(2173)^8$ × last digit of $(2173)^3$) $= 1 \times 7 = 7$.

As $(2174)^{13} = (2174)^{12} \times (2174)$, so the last digit of $(2174)^{13}$ is (last digit of $(2174)^{12}$ × last digit of (2174)) $= 6 \times 4 = 24$; so the last digit of $(2174)^{13}$ is 4.

Now last digit of $(2171)^7 + (2172)^9 + (2173)^{11} + (2174)^{13}$ is given by summing all of their last digit, i.e. $(1 + 2 + 7 + 4) = 14$, so last digit is 4.

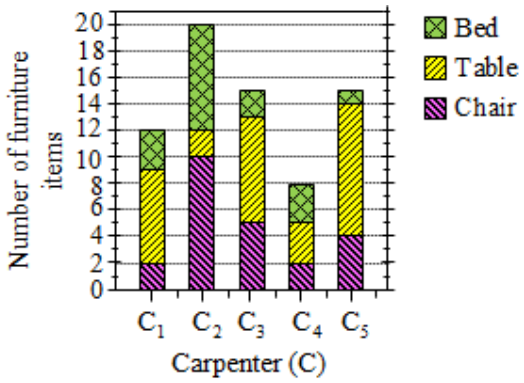
[GA – 2017 (2 marks)]: Two machines M1 and M2 are able to execute any of four jobs P, Q, R and S. The machines can perform one job on one object at a time. Jobs P, Q, R and S take 30 minutes, 20 minutes, 60 minutes and 15 minutes each respectively. There are 10 objects each requiring exactly 1 job. Job P is to be performed on 2 objects, Job Q on 3 objects, Job R on 1 objects and Job S on 4 objects. What is the minimum time needed to complete all the jobs?

(a) 2 hours (b) 2.5 hours (c) 3 hours (d) 3.5 hours

Solution (a): The total time taken by any machine to perform P, Q, R, S Jobs on objects is given in the following table. If on Machine I, Jobs P and Q will be performed in 120 minutes; then in the same time on Machine II, Jobs R and S will be performed in 120 minutes.

No. of Objects	Job Performed	Total Time
2	P	$30 \times 2 = 60$ min
3	Q	$20 \times 3 = 60$ min
1	R	$60 \times 1 = 60$ min
4	S	$15 \times 4 = 60$ min

[GA – 2017 (2 marks)]: The bar graph below shows the output of five carpenters over one month, each of whom made different items of furniture: chairs, tables, and beds.



Consider the following statements:

(i) The numbers of beds made by carpenter C_2 is exactly the same as the number of tables made by carpenter C_3.

(ii) The total number of chairs made by all carpenters is less than the total number of tablets.

Which one of the following is true?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

Solution (c): The number of beds made by carpenter C_2 is exactly the same as the number of tables made by carpenter C_3, i.e. beds made by carpenter C_2 = 8 = tables made by carpenter C_3; so statement (i) is correct.

Also total number of tables made by all carpenters $= 31$; total number of chairs made by all carpenters $= 23 < 31$; so statement (ii) is correct.

Thus option (c) is correct.

[GA – 2017 (1 mark)]: The event would have been successful if you _____ able to come.

(a) are (b) had been (c) have been (d) would have been

Solution (b): Has/had/have been is usually used for something that was done in the past and still applies. So option (b) is correct.

[GA – 2017 (1 mark)]: There was no doubt that their work was <u>thorough</u>. Which of the words below is closest in meaning to the underlined word above?

(a) pretty (b) complete (c) sloppy (d) haphazard

Solution (b): Since 'thorough' means 'complete with regard to every detail', so option (b) is correct.

[GA – 2017 (1 mark)]: What is the value of x when $81 \times (16/25)^{x+2} \div (3/5)^{2x+4} = 144$?

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(a) 1 (b) -1 (c) -2 (d) Cannot be determined

Solution: $81\times(16/25)^{x+2}\div(3/5)^{2x+4}=144\Rightarrow 81\times(4/5)^{2x+4}\div(3/5)^{2x+4}=144$

$81\times(4/3)^{2x+4}=144\Rightarrow 9\times(4/3)^{x+2}=12\Rightarrow(4/3)^{x+2}=(4/3)\Rightarrow x+2=1\Rightarrow x=-2$.

[GA – 2017 (1 mark)]: Four cards lie on a table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue.
Proposition: If a card has an even value on one side, then its opposite face is red. The card which MUST be turned over to verify the above proposition are
(a) 2, red (b) 2, 3, red (c) 2, blue (d) 2, red, blue
Solution (c): If a card has an even value on one side, then its opposite face is red; from this proposition, we can say that if a card has red face then opposite face may or may not be 2. So we have to turn the card 2; also if we turn red card, then given proposition is not verified. But on turning blue card if number is even then proposition is not correct; on the other hand on turning blue card if number is odd then proposition is correct. So option (c) is correct.

[GA – 2017 (1 mark)]: Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is
(a) $1/9$
(b) $2/9$
(c) $1/3$
(d) $4/9$

Solution: Total number of outcomes when two dice are thrown simultaneously is $6^2=36$. The number of required cases (which is given in the table) is 8. So required probability is $8/36=2/9$.

Product of numbers appearing on top faces	Number appearing on both dices is (a,b)
1	$(1,1)$
4	$(1,4)$ or $(4,1)$ or $(2,2)$
9	$(3,3)$
16	$(4,4)$
25	$(5,5)$
36	$(6,6)$

[GA – 2017 (2 marks)]: Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it look much longer. From this, what can one conclude?
(a) The centre operates on a first-come-first-served basis, but with variable service times, depending on specific customer needs.
(b) Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre.
(c) Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis.
(d) Entering the centre early ensured that one would have shorter service times and most people attempted to do this.
Solution (a): As people coming out in the same order in which they enter indicates that the centre operates on a first come first serve basis, so option (a) is correct.

[GA – 2017 (2 marks)]: A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower elevation than Gangtok. Pelling is at a lower elevation than Gangtok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok.
Which of the following statements can be inferred from the paragraph above?
(i) Pelling is at a higher elevation than Kalimpong
(ii) Kalimpong is at a lower elevation than Darjeeling
(iii) Kalimpong is at a higher elevation than Siliguri
(iv) Siliguri is at a lower elevation than Gangtok

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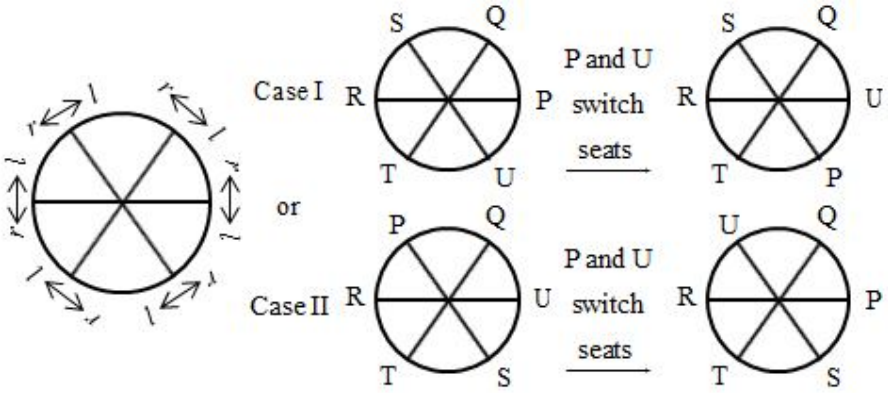
(a) Only (ii) (b) Only (ii) and (iii) (c) Only (ii) and (iv) (d) Only (iii) and (iv)

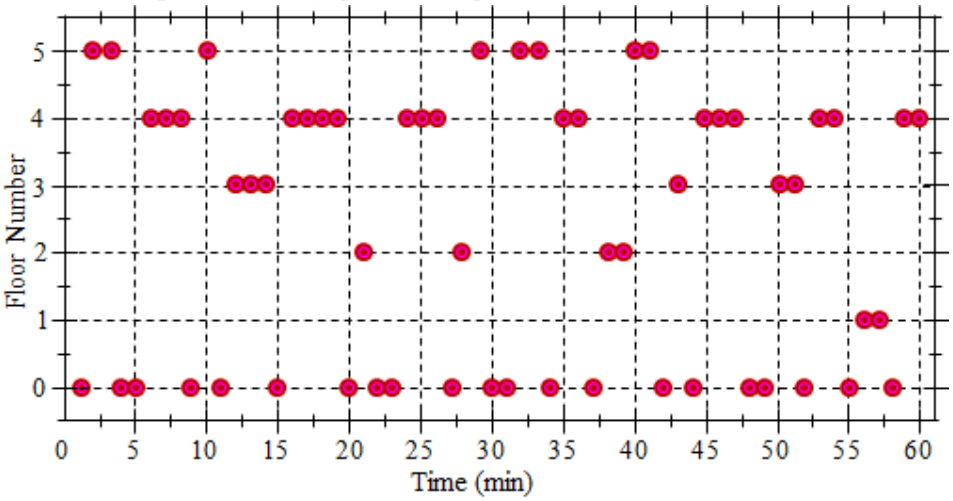
Solution (c): Let D = Darjeeling; K = Kalimpong; S = Siliguri; G = Gangtok; P = Pelling.
From the given data regarding elevation, $K < G$ …(i), $P < G$ …(ii), $P > S$ …(iii), $D > G$ …(iv).
(i) and (iv) $\Rightarrow K < G < D$ …(v); also (ii) and (iii) $\Rightarrow S < P < G$ …(vi). The given data has no relation between (v) and (vi). So from (v), statement (ii) is correct; also from (vi), statement (iv) is correct. Thus option (c) is correct.

[GA – 2017 (2 marks)]: P, Q, R, S, T and U are seated around a circular table. R is seated two places to the right of Q. P is seated three places to the left of R. S is seated opposite U. If P and U now switch seats, which of the following must necessarily be true?
(a) P is immediately to the right of R
(b) T is immediately to the left of P
(c) T is immediately to the left of P or P is immediately to the right of Q
(d) U is immediately to the right of R or P is immediately to the left of T

Solution (c): Based on the figure given, we can say that in Case I: T is immediately to the left of P; or in Case II: P is immediately to the right of Q. So option (c) is correct.



[GA – 2017 (2 marks)]: The points in the graph below represent the halts of a lift for durations of 1 minute, over a period of 1 hour.



Which of the following statements are correct?
(i) The elevator never moves directly from any non-ground floor to another non-ground floor over the one hour period.
(ii) The elevator stays on the fourth floor for the longest duration over the one hour period
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

Solution (d): Based on the given graph, it is obvious that statement (i) is incorrect. Also on the fourth floor, the elevator stays for 19 minutes; but on the ground floor, the elevator stays for 21 minutes, so statement (ii) is correct. So option (d) is correct.

[GA – 2017 (2 marks)]: Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and

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walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walks is

(a) 1 (b) 4 (c) 5 (d) 6

Solution (d): Let v_c and v_w be the speed of Budhan's cycling and walking. As distance = speed × time, so $19 = v_c \times 2 \times (1/4) + v_w \times 2(3/4) \Rightarrow v_c + 3v_w = 38$ …(i);

$26 = v_c \times 2 \times (1/2) + v_w \times 2(1/2) \Rightarrow v_c + v_w = 26$ …(ii)

From (i) and (ii), we have: $v_c = 20$ km/hr and $v_w = 6$ km/hr.

[GA – 2017 (1 mark)]: After Rajendra Chola returned from his voyage to Indonesia, he _____ to visit the temple in Thanjavur.

(a) was wishing (b) is wishing (c) wished (d) had wished

Solution (c): As both are events of past, so use of past perfect form is unwarranted as it reflects part of past. So option (c) is correct.

[GA – 2017 (1 mark)]: Research in the workplace reveals that people work for many reasons _____.

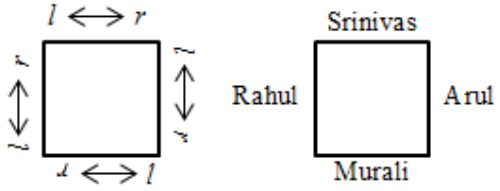
(a) money beside (b) beside money (c) money besides (d) besides money

Solution (d): As 'besides' conveys the meaning of 'in addition' or 'next to'. So option (d) is correct.

[GA – 2017 (1 mark)]: Rahul, Murali, Srinivas and Arul are seated around a square table. Rahul is sitting to the left of Murali. Srinivas is sitting to the right of Arul. Which of the following pairs are seated opposite each other?

(a) Rahul and Murali (b) Srinivas and Arul (c) Srinivas and Murali (d) Srinivas and Rahul

Solution (c): Based on the given data the following arrangement is drawn. So the pairs who are seated opposite to each other is given by (Arul, Rahul) and (Srinivas, Murali).



[GA – 2017 (1 mark)]: Find the smallest number y such that $y \times 162$ is a perfect cube.

(a) 24 (b) 27 (c) 32 (d) 36

Solution (d): The prime factorization of 162 is given by $162 = 2 \times 3 \times 3 \times 3 \times 3$. As $y \times 162$ is a perfect cube, so $y \times 162 = y \times 2 \times 3 \times 3 \times 3 \times 3 = (y \times 2 \times 3) \times (3)^3$. Thus minimum value of y, such that $y \times 162$ is a perfect cube is $y = 2^2 \times 3^2 = 36$

[GA – 2017 (1 mark)]: The probability that a k – digit number does NOT contain the digits 0, 5, or 9 is

(a) 0.3^k (b) 0.6^k (c) 0.7^k (d) 0.9^k

Solution: As each of the digits of k-digit number is filled by any of the number 1, 2, 3, 4, 6, 7, 8; so each digit of k-digit number can be filled in 7 ways, thus total number of k-digit number is 7^k.

Now total number of k-digit number whose digits are filled by any number from 0 to 9 is $9 \times 10^{k-1}$ (as fist digit can't be 0). So required probability is $\frac{7^k}{9 \times 10^{k-1}}$.

But the answer given in GATE website is option (c), which is only possible if first digit can be 0; as the total number of k-digit number then be 10^k. So required probability is $\frac{7^k}{10^k} = 0.7^k$.

So there is some language problem in the given question.

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[GA – 2017 (2 marks)]: "The hold of the nationalist imagination on our colonial past is such that anything inadequately or improperly nationalist is just not history." Which of the following statements best reflects the author's opinion?

(a) Nationalist are highly imaginative
(b) History is viewed through the filter of nationalism
(c) Our colonial past never happened
(d) Nationalism has to be both adequately and properly imagined

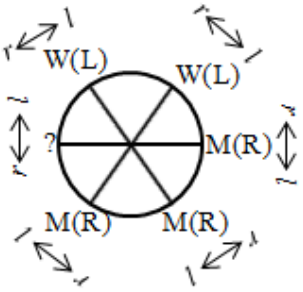
Solution (b): The words '**anything inadequately or improperly nationalist is just not history**' leads to option (b).

[GA – 2017 (2 marks)]: Six people are seated around a circular table. There are at least two men and two women. There are at least three right-handed persons. Every woman has a left-handed person to her immediate right. None of the women are right-handed. The number of women at the table is

(a) 2
(b) 3
(c) 4
(d) Cannot be determined

Solution (a): None of the women are right-handed and there are at least three right-handed persons. So at least there are three men and at least two women. Every woman has a left-handed person to her immediate right, so these two women will sit adjacently. Now as only one seat is vacant, this will be occupied by a left handed man because on right side of this seat, a right handed man is sitting.

W(L) : Left handed women
W(R) : Right handed women
M(R) : Right handed man



[GA – 2017 (2 marks)]: The expression $\{(x+y)-|x-y|\}/2$ is equal to

(a) the maximum of x and y (b) the minimum of x and y (c) 1 (d) None of the above

Solution (b): If $x > y$, then $f(x,y) = \dfrac{x+y-x+y}{2} = y$ ...(i);

If $x < y$, then $f(x,y) = \dfrac{x+y+x-y}{2} = x$ ...(ii); If $x = y$, then $f(x,y) = \dfrac{x+y-0}{2} = x = y$ ...(iii)

On combining (i), (ii) and (iii), $f(x,y) = \min(x,y)$, because if $x > y$ then $\min(x,y) = y$; if $x < y$ then $\min(x,y) = x$; if $x = y$, then $\min(x,y) = x = y$. So option (b) is correct

[GA – 2017 (2 marks)]: Arun, Gulab, Neel and Shweta must choose one shirt each from a pile of four shirts coloured red, pink, blue and white respectively. Arun dislikes the colour red and Shweta dislikes the colour white. Gulab and Neel like all the colours. In how many different ways can they choose the shirts so that no one has a shirt with a colour he or she dislikes?

(a) 21 (b) 18 (c) 16 (d) 14

Solution (d): The following table can be drawn based on the data given. So there are two 14 ways in which they can choose the shirts so that no one has a shirt with a colour he or she dislikes.

Arun	Shweta	Gulab and Neel can choose remaining shirt in
White	Red	2 ways
White	Pink	2 ways
White	Blue	2 ways
Pink	Red	2 ways
Pink	Blue	2 ways
Blue	Pink	2 ways
Blue	Red	2 ways

Alternate method: As there are 4 people Arun, Gulab, Neel and Shweta; and four colours red, pink, blue and white. So without any restriction total ways have to be $4 \times 4 = 16$ ways. Now Arun dislikes Red and Shweta dislikes white; thus total number of favourable cases will be $16 - 2 = 4$.

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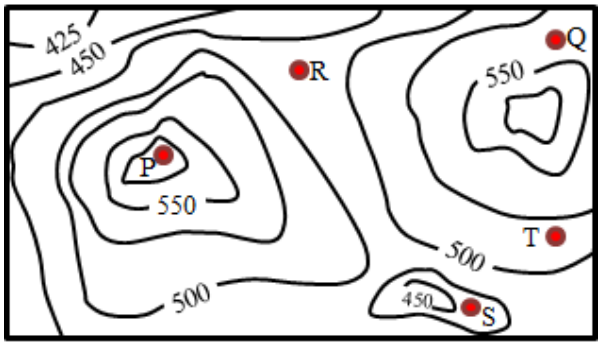
[GA – 2017 (2 marks)]: A contour line joins locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot. If in a flood, the water level rises to 525 m, which of the villages P, Q, R, S, T get submerged?



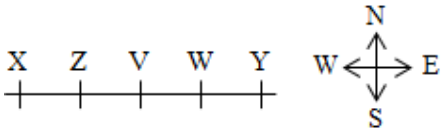
(a) P, Q
(b) P, Q, T
(c) R, S, T
(d) Q, R, S

Solution: Above the mean sea level, the height of P > 575 m; the height of Q lies between 525m to 550m; the height of R lies between 475m to 500m; the height of S lies between 450m to 475m; the height of T lies between 500m to 525m. As water level rises to 525m, so the villages whose height is less than 525m will be submerged. So R, S and T will be submerged. So option (c) is correct.

[GA – 2017 (1 mark)]: Choose the option with words that are not synonyms.
(a) aversion, dislike (b) luminous, radiant (c) plunder, loot (d) yielding, resistant
Solution (d): 'Aversion' means 'a strong dislike', so option (a) is a synonym pair. 'Luminous' means 'giving off light', so option (b) is a synonym pair. 'Plunder' means 'stealing goods from a place or person'; so option (c) is a synonym pair. 'Yielding' means 'tending to do or willing to do what other people want or to produce an indicated amount of something'; but 'Resistant' meaning 'offering resistance to something or someone', thus option (d) is not a synonym pair. Thus option (d) is correct.

[GA – 2017 (1 mark)]: Saturn is _____ to be seen on a clear night with the naked eye.
(a) enough bright (b) bright enough (c) as enough bright (d) bright as enough
Solution (b): Saturn is bright enough to be seen on a clear night with the naked eye.

[GA – 2017 (1 mark)]: There are five building called V, W, X, Y and Z in a row (not necessarily in that order). V is to the West of W. Z is to East of X and the West of V. W is to the West of Y. Which is the building in the middle?
(a) V (b) W (c) X (d) Y
Solution (a): From the data given, the following figure can be made. So the middle building is V. So option (a) is correct.



[GA – 2017 (1 mark)]: A test has twenty questions worth 100 marks in total. There are two types of questions. Multiple choice questions are worth 3 marks each and essay questions are worth 11 marks each. How many multiple choice questions does the exam have?
(a) 12 (b) 15 (c) 18 (d) 19
Solution (b): Let 'x' and 'y' be the number of multiple choice and essay questions. So $x+y=20$ …(i); $3x+11y=100$ …(ii). From (i) and (ii), we get $x=15$ and $y=5$.

[GA – 2017 (1 mark)]: There are 3 red socks, 4 green socks and 3 clue socks. You choose 2 socks. The probability that they are of the same colour is
(a) $1/5$ (b) $7/30$ (c) $1/4$ (d) $4/15$
Solution (d): Total number of ways in which 2 socks can be chosen from total 10 socks is ${}^{10}C_2$. Required number of ways in which 2 socks of same colour can be chosen is ${}^{3}C_2+{}^{4}C_2+{}^{3}C_2$. So required probability is given by $\frac{{}^{3}C_2+{}^{4}C_2+{}^{3}C_2}{{}^{10}C_2}=\frac{12}{45}=\frac{4}{15}$.

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[GA – 2017 (2 marks)]: "We lived in a culture that denied any merit to literary works, considering them important only when they were handmaidens to something seemingly more urgent - namely ideology. This was a country where all gestures, even the most private, were interpreted in political terms." The author's belief that ideology is not as important as literature is revealed by the word:

(a) 'culture' (b) 'seemingly' (c) 'urgent' (d) 'political'

Solution (b): As 'seemingly' means 'to give the impression of having a certain quality'. Thus in the given passage, the author's belief that ideology is not as important as literature is revealed by the word 'seemingly'.

[GA – 2017 (2 marks)]: There are three boxes. One contains apples, another contains oranges and the last one contains both apples and oranges. All three are known to be incorrectly labelled. If you are permitted to open just one box and then pull out and inspect only one fruit, which box would you open to determine the contents of all three boxes?

(a) The box labelled 'Apples' (b) The box labelled 'Apples and Oranges'

(c) The box labelled 'Oranges' (d) Cannot be determined

Solution (b): As all three boxes are known to be incorrectly labelled, so let us first note down the facts we know for sure:

- The box with label APPLES does not contain apples.
- The box with label ORANGES does not contain oranges.
- The box with label 'APPLES AND ORANGES' does not contain the 'Apples and Oranges' fruits.

Case 1: Opening the box with label APPLES: We know for sure that the box does not contain apples. Now when we take out a fruit from the box we can get the following:

(i) An orange: In this case we are not sure if this is an orange box or 'Apples and Oranges' box. Hence, we cannot identify the correct labels if we open the box with a label APPLE and get an orange out of it.

(ii) An apple: In this case we can identify that the box we opened is a box with 'Apples and Oranges' fruits and hence we can label it 'APPLES AND ORANGES'. Also, we can accordingly fix the labels of the remaining two boxes.

As we cannot identify the correct labels in all sub cases, hence opening the box with label APPLES is not the right choice.

Case 2: Opening the box with label ORANGES: We know for sure that the box does not contain oranges. Now when we take out a fruit from the box we can get the following:

(i) An apple: In this case we are not sure if this is an apple box or 'Apples and Oranges' box. Hence, we cannot identify the correct labels if we open the box with a label ORANGES and get an apple out of it.

(ii) An orange: In this case we can identify that the box we opened is a box with 'Apples and Oranges' fruits and hence we can label it 'APPLES AND ORANGES'. Also, we can accordingly fix the labels of the remaining two boxes.

As we cannot identify the correct labels in all sub cases, hence opening the box with label APPLES is not the right choice.

Case 3: Opening the box with label 'APPLES AND ORANGES': We know for sure that the box does not contain both the fruits. And so, the moment we take out a fruit we will definitely know the correct label of this box. Let us see what happens in the two sub cases:

(i) An apple comes out: In this case we are sure that the box contains only apples. This is because we know this box can't be a box of 'Apples and Oranges' fruits. Hence, we can identify the correct labels if we open the box with a label 'APPLES AND ORANGES' and get an apple out of it. The labels of the rest two boxes can be accordingly arranged.

(ii) An orange comes out: In this case we can identify that the box we opened is a box with oranges only. This is because we know this box can't be a box of 'Apples and Oranges' fruits. Hence, we can identify the correct labels if we open the box with a label 'APPLES AND ORANGES' and get an orange out of it. The labels of the rest two boxes can be accordingly arranged.

As we can identify the correct labels in all sub cases, hence opening the box with label 'APPLES AND ORANGES' is the right choice.

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[GA – 2017 (2 marks)]: X is a 30 digit number starting with the digit 4 followed by the digit 7. Then the number X^3 will have

(a) 90 digits (b) 91 digits (c) 92 digits (d) 93 digits

Solution (a): Let $X = (47.....)(30\,\text{digits})$

Since $47\times10^{28} < X < 48\times10^{28} \Rightarrow 47^3\times10^{84} < X^3 < 48^3\times10^{84} \Rightarrow 103823\times10^{84} < X^3 < 110592\times10^{84}$

So total number of digits in X^3 is $84+6=90$.

[GA – 2017 (2 marks)]: The number of roots of $e^x + 0.5x^2 - 2 = 0$ in the range $[-5,5]$ is

(a) 0 (b) 1 (c) 2 (d) 3

Solution (c): $f(x) = e^x + 0.5x^2 - 2$; $f(-5) = e^{-5} + 0.5(-5)^2 - 2 = 10.50$;

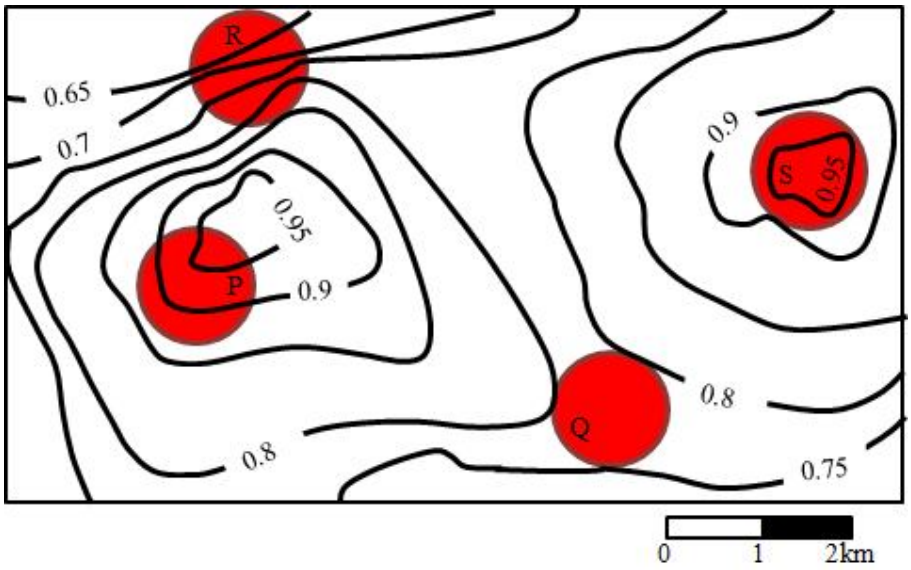
$f(-4) = e^{-4} + 0.5(-4)^2 - 2 = 6.01$; $f(-3) = e^{-3} + 0.5(-3)^2 - 2 = 2.54$;

$f(-2) = e^{-2} + 0.5(-2)^2 - 2 = 0.135$; $f(-1) = e^{-1} + 0.5(-1)^2 - 2 = -1.13$;

$f(0) = e^0 + 0.5(0)^2 - 2 = -1$; $f(1) = e^1 + 0.5(1)^2 - 2 = 1.21$; $f(2) = e^2 + 0.5(2)^2 - 2 = 7.38$; similarly $f(3)$, $f(4)$, and $f(5)$ are all positive.

As there are 2 sign changes form $+ve$ to $-ve$ and $-ve$ to $+ve$, so there are two roots of $f(x) = e^x + 0.5x^2 - 2$ in $[-5,5]$.

[GA – 2017 (2 marks)]: An air pressure contour line joins locations in a region having the same atmospheric pressure. The following is an air pressure contour plot of a geographical region. Contour lines are shown at 0.05 bar intervals in this plot. If the possibility of a thunderstorm is given by how fast air pressure rises or drops over a region, which of the following regions is most likely to have a thunderstorm?



(a) P (b) Q (c) R (d) S

Solution (c): In general thunder storms are occurred in a region where suddenly air pressure changes i.e. where sudden rise (or) sudden fall of air pressure. From the given contour map in 'R' region only more changes in air pressure. So, the possibility of a thunder storms is in region 'R'.

Region	Air pressure difference
P	0.95 – 0.90 = 0.05
Q	0.80 – 0.75 = 0.05
R	0.85 – 0.65 = 0.20
S	0.95 – 0.90 = 0.05

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Chapter 1 : English Grammar

1.1 Parts of Speech

Words are often named according to how they are used in sentences. These names for the words are called their parts of speech. The eight parts of speech in English are: **nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions, and interjections.**

Nouns: A noun is a name. The moment we name something that exists or does not exist, that name becomes a noun. A noun is the name of a person, place, thing, or an idea. For e.g. Sunny, pen, equality, weight, etc. are nouns.

- Nouns usually answer the questions who or what.
- Nouns are often preceded by 'noun markers,' the words **'a'**, **'an'**, and **'the'**. The word answering **'who** or **what'** asked after a noun marker will be a noun.
- Nouns usually form a plural by adding a **'s'**. If you are unsure if a word is a noun, try adding **'s'** to mean more than one. If it works, the word is probably a noun.
- Word endings **-ance, -ancy, -ence, -ice, -ion, -ity, -ment, -ness,** and **-ure** usually form nouns.

Pronouns: Pronouns are words which take the place of nouns to keep from repeating the nouns over and over in a sentence or paragraph.

- The most common pronouns are: **I, he, we, she, they, me, him, us, her, them, it, this, that, who, which, what.**
- One form of pronoun shows possession or ownership. These possessive pronouns work like adjectives, describing nouns. They include the words: **my, mine, his, her, hers, our, ours, their, theirs, your, yours, its,** and **whose**. Note that they do not use apostrophes.

Verbs: Verbs are words which show action or doing. All sentences must have at least one verb.

- A few verbs, called 'linking verbs,' express that someone or something exists or is a certain way. For e.g.: **be, am, is, are, was, were, been, being** are always verbs.
- Verbs change form to show a difference in time. If you change a sentence from present to past, or past to present, the words which change are verbs.
- Complete verbs may include two or more verbs working together and consisting of a main verb and 'helping verbs.' The only words that can be helping verbs are: **can, could, will, would, shall, should, may, might, must.** The words that are both main and helping are: **have, has, had, do, does, did, be, am, is, are, was, were, been, being.**
- The endings **–ify** and **–ize** usually form verbs; **-ing** or **–ed** endings are common verb forms.

Adjectives: Adjectives are words which describe only nouns. They tell what kind? Or how many?

- The noun markers **a, an,** and **the** are always adjectives.
- Adjectives pile up in front of nouns. For e.g., **the big, red, flashy car**, are adjectives describing the noun car.
- Adjectives may also follow a linking verb and describe the subject of a sentence. For e.g., The car is *big*, *red*, and *flashy*.
- The word endings **–able, -ful, - ible, - ical, -ious, -ive, -y** usually form adjectives.

Prepositions: Prepositions are common words which begin prepositional phrases (groups of words which work together). Prepositional phrases always start with a preposition and end with a noun or pronoun, and the entire phrase describes other words.

- Most prepositions indicate time, place, or position.
- The most common prepositions are: **at, to, with, from, for, of, on, in, into, onto, between, under, over, against,** and **around**.

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Conjunctions: Conjunctions are words which hook words, phrases, or sentences.

- The most common conjunctions are: **for, and, nor, but, or, yet, so**.
- Other common conjunctions are: **because, when, while, as, since, although, whenever.**

Adverbs: Adverbs describe verbs, adjectives, or other adverbs. They answer the questions: **how, when, where, why, or under what conditions.**

- A number of words are always adverbs are: **not, very, often, here, almost, always, never, there, and too.**
- Adverbs very often end with **–ly**. However, not all words ending in **–ly** are adverbs.

Interjections: Words which express emotion or are 'fillers' in sentences, but which serve little other function are called interjections.

- For e.g., the underlined words in each of these sentences are interjections: Oh, I am surprised. Ouch! I hit my hand. Yes, I am here.

It is to be noted that: The part of speech is determined by how a word is used in a sentence. The same word may be a noun, verb, adjective, preposition, or conjunction according to how it is used.

Example [GA-2014 (1 mark)]: 'Advice' is _____.
(a) a verb (b) a noun (c) an adjective (d) both a verb and a noun
Solution (b): Advice is a noun and means a suggestion about what someone should do.

Example [GA-2015 (1 mark)]: What is the adverb for the given word below? **Misogynous**
(a) Misogynousness (b) Misogynity (c) Misogynously (d) Misogynous
Solution (c): Misogyny means 'the hatred of women', which is a noun. Misogynous is an adjective and Misogynously is an adverb.

Exercise: 1.1
Select the appropriate option for the word given

1. Beetroot is	(a) a noun	(b) a verb	(c) an adjective	(d) an adverb
2. Rattle is	(a) a noun	(b) a verb	(c) both (a) and (b)	(d) an adjective
3. Arid is	(a) a noun	(b) a verb	(c) an adjective	(d) an adverb
4. Always is	(a) a noun	(b) a verb	(c) an adjective	(d) an adverb
5. League is	(a) a noun	(b) a verb	(c) both (a) and (b)	(d) an adverb
6. Amuse is	(a) a noun	(b) a verb	(c) both (a) and (b)	(d) an adjective
7. Annual is	(a) a noun	(b) a verb	(c) both (a) and (d)	(d) an adjective
8. Anxious is	(a) a verb	(b) a noun	(c) both (a) and (d)	(d) an adjective
9. Shovel is	(a) a noun	(b) a verb	(c) both (a) and (b)	(d) an adjective
10. Strategy is	(a) a noun	(b) a verb	(c) both (a) and (d)	(d) an adverb
11. Argue is	(a) a verb	(b) a noun	(c) both (a) and (d)	(d) an adverb
12. Expert is	(a) a verb	(b) a noun	(c) both (b) and (d)	(d) an adjective
13. Beg is	(a) a verb	(b) a noun	(c) both (a) and (d)	(d) an adverb
14. Finally is	(a) a verb	(b) a noun	(c) both (b) and (d)	(d) an adverb
15. Brisk is	(a) a verb	(b) a noun	(c) both (a) and (d)	(d) an adjective
16. Antique is	(a) a verb	(b) an adverb	(c) both (a) and (d)	(d) an adjective
17. Ample is	(a) a verb	(b) a noun	(c) both (a) and (d)	(d) an adjective
18. Applaud is	(a) a verb	(b) a noun	(c) both (a) and (b)	(d) an adverb
19. Poet is	(a) a noun	(b) a verb	(c) an adverb	(d) an adjective
20. Everyone is	(a) a noun	(b) a pronoun	(c) a verb	(d) an adjective
21. Charity is	(a) a noun	(b) a pronoun	(c) a verb	(d) an adjective
22. Badly is	(a) a noun	(b) a verb	(c) an adverb	(d) an adjective

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23. Bitter is	(a) a noun	(b) a verb	(c) both (a) and (d)	(d) an adjective
24. Bluff is	(a) a verb	(b) a noun	(c) both (a) and (b)	(d) an adverb
25. Although is	(a) a verb	(b) a noun	(c) a conjunction	(d) an adverb
26. Amen is	(a) a verb	(b) an adverb	(c) an interjection	(d) an adjective
27. Divine is	(a) a noun	(b) a adverb	(c) both (a) and (d)	(d) an adjective
28. Extend is	(a) a verb	(b) a noun	(c) both (a) and (b)	(d) an adverb
29. Gladly is	(a) a verb	(b) a noun	(c) both (b) and (d)	(d) an adverb
30. Unless is	(a) a noun	(b) a pronoun	(c) a conjunction	(d) an adjective
31. Around is	(a) a verb	(b) an adverb	(c) a preposition	(d) both (b) and (c)
32. Despite is	(a) a noun	(b) a verb	(c) a preposition	(d) both (a) and (c)
33. Gracious is	(a) a verb	(b) an adjective	(c) an interjection	(d) both (b) and (c)
34. Mortally is	(a) a verb	(b) an adverb	(c) an adjective	(d) both (b) and (c)
35. Provided is	(a) a verb	(b) an adverb	(c) a preposition	(d) a conjunction
36. Aboard is	(a) a verb	(b) an adverb	(c) a preposition	(d) both (b) and (c)
37. Versus is	(a) a verb	(b) an adjective	(c) a preposition	(d) a conjunction
38. Whew is	(a) a verb	(b) an adjective	(c) an interjection	(d) a conjunction
39. Excluding is	(a) a verb	(b) an adverb	(c) a conjunction	(d) a preposition
40. Lest is	(a) a verb	(b) an adjective	(c) a conjunction	(d) an interjection
41. 'After life' is	(a) a noun	(b) a verb	(c) a preposition	(d) both (a) and (c)
42. Somebody is	(a) a noun	(b) a pronoun	(c) an adjective	(d) an adverb
43. Just is	(a) a noun	(b) an adjective	(c) an adverb	(d) both (b) and (c)
44. Astride is	(a) a verb	(b) an adverb	(c) a preposition	(d) both (b) and (c)
45. 'On line' is	(a) a noun	(b) a verb	(c) a preposition	(d) both (a) and (c)
46. Seldom is	(a) a verb	(b) an adverb	(c) an adjective	(d) both (b) and (c)
47. Awesome is	(a) a verb	(b) an adverb	(c) an adjective	(d) both (b) and (c)
48. Modify is	(a) a verb	(b) an adverb	(c) an adjective	(d) both (a) and (b)
49. Religion is	(a) a verb	(b) a noun	(c) an interjection	(d) both (a) and (c)
50. Someone is	(a) a noun	(b) a pronoun	(c) a verb	(d) both (a) and (c)
51. 'Fond of' is	(a) a noun	(b) an adjective	(c) a preposition	(d) both (b) and (c)
52. Nearby is	(a) a noun	(b) an adjective	(c) an adverb	(d) both (b) and (c)
53. Today is	(a) a noun	(b) an adverb	(c) an adjective	(d) both (a) and (b)
54. Felt is	(a) a noun	(b) a verb	(c) an adverb	(d) both (a) and (b)
55. Within is	(a) a verb	(b) an adverb	(c) a preposition	(d) both (b) and (c)
56. Beside is	(a) a verb	(b) an adverb	(c) a preposition	(d) both (a) and (c)
57. Friendly is	(a) a noun	(b) a verb	(c) an adjective	(d) both (a) and (c)
58. Straight is	(a) a verb	(b) an adverb	(c) an adjective	(d) both (b) and (c)
59. Incredibly is	(a) a verb	(b) an adverb	(c) an adjective	(d) a noun
60. Envious	(a) a verb	(b) an adverb	(c) an adjective	(d) a noun
61. Abroad is	(a) a verb	(b) an adverb	(c) a noun	(d) both (b) and (c)
62. Tragic is	(a) a verb	(b) an adjective	(c) a noun	(d) both (b) and (c)
63. Pitiful is	(a) a verb	(b) an adjective	(c) an adverb	(d) both (a) and (b)
64. Lend is	(a) a verb	(b) an adjective	(c) an adverb	(d) both (a) and (c)
65. Hourly is	(a) a verb	(b) an adjective	(c) an adverb	(d) both (b) and (c)

Exercise 1.2

For questions 1 to 15: Select which part of speech is the underlined word in the given sentence.
For questions 16 to 65: Directions given in questions.

1. I bought a <u>beautiful</u> dress at the mall.
(a) a noun (b) verb (c) an adjective (d) an adverb

2. I left my shoes <u>under</u> the kitchen table.
(a) a conjunction (b) an interjection (c) an adjective (d) a preposition

3. If we finish our work <u>quickly</u> we can go to the movies.

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(a) a verb (b) an adverb (c) an interjection (d) a preposition

4. What did <u>she</u> ask you to do?
(a) a noun (b) a pronoun (c) a verb (d) an adverb

5. <u>Well</u>, I don't think I will be her to answer the phone.
(a) an interjection (b) a preposition (c) a conjunction (d) an adverb

6. Sunny knocked on the door <u>but</u> nobody answered.
(a) an interjection (b) a conjunction (c) a preposition (d) a verb

7. Whenever the door slams, the lamp <u>rocks</u> back and forth.
(a) an adjective (b) a noun (c) a verb (d) an adverb

8. The garden wall is made of <u>rocks</u>.
(a) an adjective (b) a noun (c) a verb (d) an adverb

9. The college's geology department has a large <u>rock</u> collection.
(a) an adjective (b) a noun (c) a verb (d) an adverb

10. Feathers are so <u>light</u> that they seem to float.
(a) an adjective (b) a noun (c) a verb (d) an adverb

11. Open the window and let in the <u>light</u>.
(a) an adjective (b) a noun (c) a verb (d) an adverb

12. Remember to drive <u>safely</u>.
(a) an adjective (b) a noun (c) a verb (d) an adverb

13. Don't <u>talk</u> like that
(a) an adjective (b) a noun (c) a verb (d) an adverb

14. Let's do <u>it</u>.
(a) a noun (b) a pronoun (c) a verb (d) an adjective

15. The cat is <u>on</u> the table.
(a) a preposition (b) a conjunction (c) an interjection (d) an adjective

16. Adjective of 'Admire' is
(a) Admiration (b) Admirable (c) Admirous (d) Admiratious

17. Verb of 'Advice' is
(a) Advise (b) Advisation (c) Advicely (d) Advisable

18. Noun of 'Actively' is
(a) Active (b) Activity (c) Act (d) Activious

19. Verb of 'Mass' is
(a) Massive (b) Massively (c) Amass (d) Massious

20. Adverb of 'Care' is
(a) Care (b) Careful (c) Carefulness (d) Carefully

21. Adjective of 'Attend' is
(a) Attention (b) Attentive (c) Attentively (d) Attentivious

22. Noun of 'Avoidable' is
(a) Avoid (b) Avoidance (c) Avoidely (d) Avoidation

23. Verb of 'Botheration' is
(a) Bothering (b) Botherly (c) Botheration (d) Bother

24. Adverb of 'Cheer' is
(a) Cheerfulness (b) Cheerful (c) Cheerfully (d) Cheerious

25. Noun of 'Chosen' is
(a) Choose (b) Choice (c) Chose (d) Choosenly

26. Adjective of 'Comfort' is
(a) Comfort (b) Comfortable (c) Comfortably (d) Comfortious

27. Adverb of 'Continue' is
(a) Continue (b) Continuity (c) Continuous (d) Continuously

28. Verb of 'Credit' is
(a) Credit (b) Creditable (c) Creditably (d) Creditious

29. Verb of 'Destructively' is
(a) Destroy (b) Destruction (c) Destructive (d) Destructively

30. Adverb of 'Different' is
(a) Differ (b) Difference (c) Different (d) Differently

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31. Noun of 'Empower' is
(a) Power (b) Powerful (c) Powerfully (d) Powerfulness

32. Adjective of 'Circle' is
(a) Encircle (b) Circle (c) Circular (d) Circularly

33. Verb of 'Courageous' is
(a) Encourage (b) Courage (c) Courageous (d) Courageously

34. Verb of 'Envy' is
(a) Envy (b) Envious (c) Enviously (d) Envitious

35. Adjective of 'Expect' is
(a) Expect (b) Expectation (c) Expected (d) Expectedly

36. Noun of 'Firm' is
(a) Firm (b) Firmness (c) Firmly (d) Fermious

37. Adjective of 'Force' is
(a) Force (b) Forceful (c) Forcefully (d) Forcefulious

38. Verb of 'Glory' is
(a) Glorify (b) Glory (c) Glorious (d) Gloriously

39. Adverb of 'Growth' is
(a) Grow (b) Growth (c) Growing (d) Growingly

40. Adverb of 'Hatred' is
(a) Hate (b) Hatred (c) Hateful (d) Hatefully

41. Verb of 'Health' is
(a) Health (b) Heal (c) Healthy (d) Healthily

42. Noun of 'Imitatively' is
(a) Imitate (b) Imitation (c) Imitative (d) Imitatively

43. Adjective of 'Impress' is
(a) Impress (b) Impression (c) Impressive (d) Impressively

44. Adverb of 'Inclusion' is
(a) Include (b) Inclusion (c) Inclusive (d) Inclusively

45. Adjective of 'Indicate' is
(a) Indication (b) Indicate (c) Indicatively (d) Indicative

46. Verb of 'Injuriously' is
(a) Injure (b) Injury (c) Injurious (d) Injurely

47. Noun of 'Insult' is
(a) Insult (b) Insultious (c) Insulting (d) Insultingly

48. Adjective of 'Irritate' is
(a) Irritate (b) Irritating (c) Irritation (d) Irritatingly

49. Verb of 'Life' is
(a) Alive (b) Livingly (c) Lively (d) Live

50. Adjective of 'Madden' is
(a) Madness (b) Mad (c) Madly (d) Madious

51. Adjective of 'Monotony' is
(a) Monotonies (b) Monotony (c) Monotonous (d) Monotonously

52. Adverb of 'National' is
(a) Nationalise (b) Nationality (c) Nationalisation (d) Nationwide

53. Verb of 'Quick' is
(a) Quicken (b) Quickness (c) Quickly (d) Quickious

54. Adverb of 'Sadden' is
(a) Sadness (b) Sad (c) Sadly (d) Saddenly

55. Adjective of 'Security' is
(a) Secure (b) Security (c) Secured (d) Securely

56. Adverb of 'Belief' is
(a) Believable (b) Believably (c) Beliefly (d) Believe

57. Noun of 'Critical' is
(a) Criticizely (b) Critically (c) Criticism (d) Criticize

58. Verb of 'Flexible' is

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(a) Flexibly (b) Flexibility (c) Flex (d) Flexibious

59. Adjective of 'Harmonize' is
(a) Harmonious (b) Harmoniously (c) Harmony (d) Harmonely

60. Verb of 'Legitimate' is
(a) Legitimately (b) Legitimacy (c) Legitimize (d) Legitimatious

61. Noun of 'Offend' is
(a) Offensive (b) Offensively (c) Offendness (d) Offensiveness

62. Adjective of 'Reverse' is
(a) Reverse (b) Reversely (c) Reversibility (d) Reversible

63. Verb of 'Romantic' is
(a) Romantically (b) Romantic (c) Romanticize (d) Romantious

64. Adverb of 'Success' is
(a) Successful (b) Successfully (c) Successly (d) Succeed

65. Verb of 'Symbolically' is
(a) Symbolic (b) Symbolically (c) Symbolize (d) Symbol

1.2 Sentences

1.2.1 Grammatically Correct Sentence

Example [GA – 2016 (1 mark)] Out of the following four sentences, select the most suitable sentence with respect to grammar and usage.
(a) I will not leave the place until the minister does not meet me.
(b) I will not leave the place until the minister doesn't meet me.
(c) I will not leave the place until the minister meet me.
(d) I will not leave the place until the minister meets me.
Solution (d): Any sentence cannot take more than one negative. As 'until' itself is negative so it cannot take one more negative, i.e. 'does not' or doesn't, hence option (a) and (b) are not correct. Since in any sentence the verb of a sentence must agree with the subject in number and in person; so option (c) is not correct and option (d) is correct.

Example [GA – 2016 (1 mark)] The man who is now Municipal Commissioner worked as _____.
(a) the security guard at a university (b) a security guard at the university
(c) a security guard at university (d) the security guard at the university
Solution (b): The word 'the' is used before some nouns that refer to place when you want to mention that type of place; thus options (a) and (d) are not correct because of the word 'the security'. Also option (c) is not correct and option (b) is correct.

Example [GA – 2016 (1 mark)] Identify the correct spelling out of the given options:
(a) Managable (b) Manageable (c) Mangaeble (d) Managible
Solution (b):
Options (a), (c) and (d) are not any word, so the correct word is 'manageable'; so option (b) is correct.

Exercise: 1.3
In all the following questions choose the grammatically CORRECT sentence.

1.	**[GA-2012 (1 mark)]:** (a) He laid in bed till 8 o'clock in the morning. (b) He layed in bed till 8 o'clock in the morning. (c) He lain in bed till 8 o'clock in the morning. (d) He lay in bed till 8 o'clock in the morning.
2.	**[GA-2013 (1 mark)]:** (a) Two and two add four. (b) Two and two become four. (c) Two and two are four.

	(d) Two and two make four.
3.	**[GA-2015 (2 mark)]:** (a) Since the report lacked needed information, it was of no use to them. (b) The report was useless to them because there were no needed information in it. (c) Since the report did not contain the needed information, it was not real useful to them. (d) Since the report lacked needed information, it would not had been useful to them.
4.	**Example [GA-2015 (2 mark)]:** *Ram and Shyam shared a secret and promised to each other that it would remain between them.* Ram expressed himself in one of the following ways as given in the choices below. Identify the correct way as per standard English. (a) It would remain between you and me. (b) It would remain between I and you. (c) It would remain between you and I. (d) It would remain with me.
5.	(a) The head chef was very surprising to see the housefly in kitchen. (b) The head chef was very surprise to see the housefly in kitchen. (c) The head chef was very surprised to see the housefly in kitchen. (d) The head chef was very surprisingly to see the housefly in kitchen.
6.	(a) The event was ill-timed and the venue less than three-quarters full. (b) The event was ill timed and the venue less than three-quarters full. (c) The event was ill timed and the venue less than three quarters full. (d) The event was ill-timed and the venue less than three quarters full.
7.	(a) We will have lunch in a hour. (b) We will have lunch in an hour. (c) We will have lunch in one hour. (d) We will have lunch in the hour.
8.	(a) They spent all month of May in the China town and the sun shown almost each day. (b) They spent all month of May in the China town and the sun shown almost every day. (c) They spent the whole month of May in the China town and the sun shown almost every day. (d) They spent the whole month of May in the China town and the sun shown almost each day.
9.	(a) They had asked everyone and still have not discovered who's pen it is. (b) They have asked everyone and still have not discovered whose pen it is. (c) They have asked everyone and still have not discovered who's pen it is. (d) They had asked everyone and still have not discovered whose pen it is.
10.	(a) I asked Shilpa if she was going to the film, are you planning to go. (b) I asked Shilpa if she was going to the film? Are you planning to go? (c) I asked Shilpa if she was going to the film. Are you planning to go? (d) I asked Shilpa if she was going to the film. Are you planning to go.
11.	(a) The newspaper make the presumption that was a self-portrait. (b) The newspaper make the presumption that it was a self-portrait. (c) The newspaper made the presumption that was a self-portrait. (d) The newspaper made the presumption that it was a self-portrait.
12.	(a) The statement from the solicitor was utterly incomprehensible. (b) The statement from the solicitor was a bit incomprehensible. (c) The statement from the solicitor was very incomprehensible. (d) The statement from the solicitor was extremely incomprehensible.
13.	(a) As soon as she finishes her last assignment she will be let loose on the next one. (b) As soon as she finishes her last assignment she will be let lose on the next one. (c) As soon as she finishes her latest assignment she will be let loose on the next one. (d) As soon as she finishes her latest assignment she will be let lose on the next one.
14.	(a) The incidence of heart disease correlate positively with the level of salt ingested. (b) The incidence of heart disease correlate positively to the level of salt ingested. (c) The incidence of heart disease correlates positively to the level of salt ingested. (d) The incidence of heart disease correlates positively with the level of salt ingested.
15.	(a) I did not get the message because it arrived after I had left for the meeting. (b) I did not get the message because it arrived no sooner I had left for the meeting. (c) I did not get the message because it arrived until I had left for the meeting.

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	(d) I did not get the message because it arrived before I had left for the meeting.
16.	(a) She told us 'Mine favourite was maggie sausages'. (b) She told us 'Mine favourite was Maggie sausages'. (c) She told us 'My favourite was maggie sausages'. (d) She told us 'My favourite was Maggie sausages'.
17.	(a) An arthropod is an invertebrate with a segmented body and hard outer shells. (b) An arthropod is an invertebrate with a segmented body and the hard outer shell. (c) An arthropod is an invertebrate with a segmented body and a hard outer shell. (d) An arthropod is an invertebrate with a segmented body and the hard outer shells.
18.	(a) The hydrogen is both the simplest and the most abundant element in the universe. (b) A hydrogen is both the simplest and the most abundant element in the universe. (c) An hydrogen is both the simplest and the most abundant element in the universe. (d) Hydrogen is both the simplest and the most abundant element in the universe.
19.	(a) When the meteors enter the Earth's atmosphere they lose much of their mass due to friction. (b) When meteor enters the Earth's atmosphere, they lose much of their mass due to friction. (c) When the meteor enters the Earth's atmosphere, they lose much of their mass due to friction. (d) When meteors enter the Earth's atmosphere, they lose much of their mass due to friction.
20.	(a) A neutralist seeks to observe animals in their natural habitats without disruption or intrusion. (b) A neutralist seeks to observe animals in a natural habitats without disruption or intrusion. (c) A neutralist seeks to observe animals in its natural habitats without disruption or intrusion. (d) A neutralist seeks to observe animals in his natural habitats without disruption or intrusion.
21.	(a) Badgers emerging at night to forage for food. (b) Badgers emerge at night to forage for food. (c) Badgers emerges at night to forage for food. (d) Badgers are emerging at night to forage for food.
22.	(a) The shark possesses either lungs nor swim bladders. (b) The shark has possessed both lungs nor swim bladders. (c) The shark is possessing no lungs nor swim bladders. (d) The shark possesses neither lungs nor swim bladders.
23.	(a) The value of Indian rupee drops since the early 1980s. (b) The value of Indian rupee have dropped since the early 1980s. (c) The value of Indian rupee dropping since the early 1980s. (d) The value of Indian rupee has dropped since the early 1980s.
24.	(a) Long before he was a famous artist, to sell his designs on subway platforms. (b) Long before he was a famous artist, has sold his designs on subway platforms. (c) Long before he was a famous artist, was sold his designs on subway platforms. (d) Long before he was a famous artist, sold his designs on subway platforms.
25.	(a) The belief in vampires was first recorded in India in the early fifteenth century. (b) The belief in vampires had first been recorded in India in the early fifteenth century. (c) The belief in vampires that was first recorded in India in the early fifteenth century. (d) The belief in vampires was recording in India in the early fifteenth century.
26.	(a) Primary malnutrition is caused by a lack of essential foodstuffs. (b) Primary malnutrition will cause the lack of essential foodstuffs. (c) Primary malnutrition won't cause the lack of essential foodstuffs. (d) Primary malnutrition has been causing the lack of essential foodstuffs.
27.	(a) By the year 2001, the Italian peninsula will not be united as one country for 140 years. (b) By the year 2001, the Italian peninsula will be united as one country for 140 years. (c) By the year 2001, the Italian peninsula will have been united as one country for 140 years. (d) By the year 2001, the Italian peninsula has been united as one country for 140 years.
28.	(a) New Delhi, the capital of India, is forty times the smallest Mumbai city. (b) New Delhi, the capital of India, is forty times smaller than Mumbai. (c) New Delhi, the capital of India, is forty times small as Mumbai.

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	(d) New Delhi, the capital of India, is forty times more small than Mumbai.
29.	(a) The term tarantula is used to describe many different and unrelating species of giant spiders. (b) The term tarantula is used to describe many different and most unrelating species of giant spiders. (c) The term tarantula is used to describe many different and unrelated species of giant spiders. (d) The term tarantula is used to describe many differed and unrelating species of giant spiders.
30.	(a) Skunks have highly offensive scent glands which enable they to ward off predators. (b) Skunks have highly offensive scent glands which enable them to ward off predators. (c) Skunks have highly offensive scent glands which enable their to ward off predators. (d) Skunks have highly offensive scent glands which enable its to ward off predators.
31.	(a) Humans reliance on fire gives them the power to destroy or create. (b) Humans' reliance on fire gives them the power to destroy or create. (c) Human's reliance on fire gives them the power to destroy or create. (d) Humans's reliance on fire gives them the power to destroy or create.
32.	(a) Careful planning and appropriate timing are two key elements in military strategies. (b) Carefully planning and appropriately timed are two key elements in military strategies. (c) Carefully planning and appropriate timing are two key elements in military strategies. (d) Careful planned and appropriately timed are two key elements in military strategies.
33.	(a) The giant panda has a predominant white body with black ears, limbs and eye patches. (b) The giant panda has a predominantly whitely body with black ears, limbs and eye patches. (c) The giant panda has a predominantion of white body with black ears, limbs and eye patches. (d) The giant panda has a predominantly white body with black ears, limbs and eye patches.
34.	(a) Increasing industrialization is warming the climate and melting the polar icecaps. (b) Increase industry is warming the climate and melting the polar icecaps. (c) Industrial increasing is warming the climate and melting the polar icecaps. (d) Industrialization increased is warming the climate and melting the polar icecaps.
35.	(a) Waters from the Nile nourished a long-lived civilization. (b) Waters from the Nile nourished a longer living civilization. (c) Waters from the Nile nourished a longest lived civilization. (d) Waters from the Nile nourished a longly lived civilization.
36.	(a) Harvesting oranges is not as complex as to grow and cultivate them. (b) Harvesting oranges is not as complex as they are to grow and cultivate. (c) Harvesting oranges is not as complex as grow and cultivate them. (d) Harvesting oranges is not as complex as growing and cultivating them.
37.	(a) The scientific study of animal life is known as zoology. (b) To study scientifically of animal life is known as zoology. (c) That is scientific studying of animal life is known as zoology. (d) Studying scientific of animal life is known as zoology.
38.	(a) The ozone player plays a major part in to filter out the ultraviolet rays of the sun. (b) The ozone player plays a major part in filtering out the ultraviolet rays of the sun. (c) The ozone player plays a major part in filter out in the ultraviolet rays of the sun. (d) The ozone player plays a major part in filtered the ultraviolet rays of the sun.
39.	(a) A voracious predator, the python can swallow its prey to dislocate its jaws. (b) A voracious predator, the python can swallow its prey by dislocating its jaws. (c) A voracious predator, the python can swallow its prey for dislocating its jaws. (d) A voracious predator, the python can swallow its prey by dislocating its jaws.
40.	(a) Smallpox, a disease highly contagious, causes a high fever and severe skin eruptions. (b) Smallpox, that contagious disease, causes a high fever and severe skin eruptions. (c) Smallpox, a highly contagious disease, causes a high fever and severe skin eruptions. (d) Smallpox, disease highly contagious, causes a high fever and severe skin eruptions.
41.	(a) The Mississippi, the longest river in North America, runs through the United States. (b) The Mississippi, North America's longest river, runs through the United States. (c) The Mississippi, along the river in North America, runs through the United States. (d) The Mississippi, that river is the longest, runs through the United States.

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42. (a) Carl Lewis who is one of the few athletes who has won ten gold medals.
(b) Carl Lewis is few who athletes who has won ten gold medals.
(c) Carl Lewis one of the few athletes who has won ten gold medals.
(d) Carl Lewis is one of the few athletes who has won ten gold medals.

43. (a) Milk, from which cheese is made, may be drunk raw, pasteurized, sour, or skimmed.
(b) Milk, which cheese is made, may be drunk raw, pasteurized, sour, or skimmed.
(c) Milk, which is made from cheese, may be drunk raw, pasteurized, sour, or skimmed.
(d) Milk, from which is cheese made, may be drunk raw, pasteurized, sour, or skimmed.

44. (a) Unlike a tornado it occurs on land, a hurricane occurs on the ocean.
(b) Unlike a tornado occurring on land, a hurricane occurs on the ocean.
(c) Unlike a tornado which occurs on land, a hurricane occurs on the ocean.
(d) Unlike a tornado occurred on land, a hurricane occurs on the ocean.

45. (a) A football team consist of eleven members, who each of must wear protective equipment.
(b) A football team consist of eleven members, of each whose must wear protective equipment.
(c) A football team consist of eleven members, to whom each must wear protective equipment.
(d) A football team consist of eleven members, each of whom must wear protective equipment.

46. (a) Darwin proposed that humans evolved from apes.
(b) Darwin proposed that humans evolved of apes.
(c) Darwin proposed that humans evolved down from apes.
(d) Darwin proposed that humans evolved with apes.

47. (a) Natal is a South African province located on the Indian Ocean.
(b) Natal is a South African province located at the Indian Ocean.
(c) Natal is a South African province located aside the Indian Ocean.
(d) Natal is a South African province located to the Indian Ocean.

48. (a) A great amount of thrust is needed to lift an airplane of the ground during takeoff.
(b) A great amount of thrust is needed to lift an airplane off the ground while takeoff.
(c) A great amount of thrust is needed to lift an airplane off the ground during takeoff.
(d) A great amount of thrust is needed to lift an airplane of the ground on takeoff.

49. (a) Magma is the molten material found in Earth's crust or upper mantle.
(b) Magma are molten materials found in Earth's crust or upper mantle.
(c) Magma is a molten material found in Earth's crust or upper mantle.
(d) Magma are the molten materials found in Earth's crust or upper mantle.

50. (a) Much papers used today is recycled.
(b) Much of the paper used today is recycled.
(c) Many paper used today is recycled.
(d) Much of papers used today is recycled.

51. (a) Brazil produces most coffee than any other country.
(b) Brazil produced the more coffee than any other country.
(c) Brazil produces more coffee than any other country.
(d) Brazil produces bigger coffee than any other country.

52. (a) Improvements in the economy may sometimes explain periods of lesser crimes.
(b) Improvements in the economy may sometimes explain periods of fewer crimes.
(c) Improvements in the economy may sometimes explain periods of little crimes.
(d) Improvements in the economy may sometimes explain periods of less crimes.

53. (a) A lot sunlight is needed for cacti to grow indoors.
(b) A lot of sunlight is needed for cacti to grow indoors.
(c) A lot of the sunlight is needed for cacti to grow indoors.
(d) A lots of sunlight is needed for cacti to grow indoors.

54. (a) Only a small amount of plastic explosive are needed to cause extensive damage.
(b) Only a small amount of plastic explosive is needed to cause extensive damage.
(c) Only a small amount of plastic explosive needed to cause extensive damage.
(d) Only a small amount of plastic explosive needs to cause extensive damage.

55. (a) Most of the material used in glassmaking is silicon sand.
(b) Most materials are used in glassmaking is silicon sand.

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	(c) Much of the materials used in glassmaking is silicon sand. (d) Many of the materials used in glassmaking is silicon sand.
56.	(a) The more powerful the tennis serve, the more difficult it is to return it. (b) The more powerful the tennis serve, the more difficult the return. (c) The more powerful the tennis serve, the more difficulty the other player has. (d) The more powerful the tennis serve, the more difficult played the return.
57.	(a) Spiders kill their prey by suffocation, injecting them with poison, or simply by starving them. (b) Spiders suffocate their pray, injecting them with poison, or simply by starving them. (c) Spiders suffocating their pray, injecting them with poison, or simply by starving them. (d) Spiders kill their prey by suffocating them, injecting them with poison, or simply by starving them.
58.	(a) Menthol, which can be made by dry distillations of wood, is the simplest alcohol. (b) Menthol, which can be made by the dry distillation of woods, is the simplest alcohol. (c) Menthol, which can be made by the dry distillation of wood, is the simplest alcohol. (d) Menthol, which can be made by dry distillations of woods, is the simplest alcohol.
59.	(a) The Ohio River begins in the confluence of the Allegheny and Monongahela Rivers. (b) The Ohio River begins of the confluence of the Allegheny and Monongahela Rivers. (c) The Ohio River begins at the confluence of the Allegheny and Monongahela Rivers. (d) The Ohio River begins nearby the confluence of the Allegheny and Monongahela Rivers.
60.	(a) The Gestapo exercised virtually unlimited power while Germany was controlled by the Nazi Party. (b) The Gestapo exercised virtually unlimited power during Germany was controlled by the Nazi Party. (c) The Gestapo exercised virtually unlimited power as Germany controlled by the Nazi Party. (d) The Gestapo exercised virtually unlimited power during that Germany was controlled by the Nazi Party.
61.	(a) An Olympic team is composed of the athletes and the coaches who instruct them. (b) An Olympic team is composed of the athletes and the coaches instructed them. (c) An Olympic team is composed of the athletes and the coaches to whom instruct them. (d) An Olympic team is composed of the athletes and the coaches whose instructions them.
62.	(a) Uranus is physical very similar to Neptune, but much larger. (b) Uranus is physically very similar to Neptune, but much larger. (c) Uranus is physically very similarly to Neptune, but much larger. (d) Uranus is physical very similarly to Neptune, but much larger.
63.	(a) Henry Thoreau's Walden Pond was a place which inspired him to write his books. (b) Henry Thoreau's Walden Pond was a place by inspiring him to write his books. (c) Henry Thoreau's Walden Pond was a place where he inspired to write his books. (d) Henry Thoreau's Walden Pond was a place inpired to write his books.
64.	(a) Philadelphia is called the City of Brotherly Love since its founding in 1681. (b) Philadelphia has been called the City of Brotherly Love since its founding in 1681. (c) Philadelphia is calling the City of Brotherly Love since its founding in 1681. (d) Philadelphia calls the City of Brotherly Love since its founding in 1681.
65.	(a) She loved to travel so she could know people from all around the world. (b) She loved to travel so she could get to know people from round the world. (c) She loved to travel so she could knew about people from around the world. (d) She loved to travel so she could get knowing people from round the world.
66.	(a) Physics is a branch of science defined as the study of matter, energy, and the relationship between them. (b) Physics is a branch of science defined as the study of matter, energy, and their relation. (c) Physics is a branch of science defined as the study of matter, energy, and the relation of it. (d) Physics is a branch of science defined as the study of matter, energy, and they relate between it.
67.	(a) To travel from Indian to Nepal you don't need a passport.

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	(b) To travel from Indian to Nepal you haven't got a passport. (c) To travel from Indian to Nepal you needn't a passport. (d) To travel from Indian to Nepal you mustn't have a passport.
68.	(a) If you hadn't taken such a long time to get dressed, we'd have been there by now. (b) If you wouldn't have taken such a long time to get dressed, we'd have been there by now. (c) If you wouldn't take such a long time to get dressed, we'd have been there by now. (d) If you weren't taking such a long time to get dressed, we'd have been there by now.
69.	(a) I have real already twice this book. (b) I already twice read have this book. (c) I twice have already read this book. (d) I have already read this book twice.

Example [GA – 2016 (1 mark)]: Which of the following is **CORRECT** with respect to grammar and usage? **Mount Everest is _____.**

(a) the highest peak in the world (b) highest peak in the world
(c) one of highest peak in the world (d) one of the highest peak in the world

Solution (a): As "one of" the expression should take plural noun, so options (c) and (d) are not correct. Since, 'the' is used before superlative article, and so option (a) is correct and (b) is not correct.

Example [GA – 2016 (1 mark)]: The policeman asked the victim of a theft, "What did you ____?"

(a) loose (b) lose (c) loss (d) louse

Solution (b): Loose is used for describing items that are not tied back, so option (a) is not correct. Lose is used for a person who is no longer possess something because he/she do not know where it is, or because it has been taken away from him/her, so option (b) is correct. Loss is used when a person no longer have something or have less of something, so option (c) is not correct. Louse is a very small insect that lives on the bodies or in the hair of people and animals, so option (d) is not correct.

Example [GA – 2016 (1 mark)]: The volume of a sphere of diameter 1 unit is _____ than the volume of a cube of side 1 unit.

(a) least (b) less (c) lesser (d) low

Solution (c): As the sentence is in comparative degree, so **'lesser'** is the suitable word.

Example [GA – 2016 (1 mark)]: The unruly demanded that the accused be _____ without trial.

(a) hanged (b) hanging (c) hankering (d) hung

Solution (a): As after 'be' the past-participle verb is used so 'hanged' is the appropriate word.

Example [GA – 2016 (1 mark)]: Based on the given statements, select the appropriate option with respect to grammar and usage. Statements:

(i) The height of Mr. **X** is 6 feet. (ii) The height of Mr. **Y** is 5 feet.
(a) Mr. **X** is longer than Mr. **Y**. (b) Mr. **X** is more elongated than Mr. **Y**.
(c) Mr. **X** is taller than Mr. **Y**. (d) Mr. **X** is lengthier than Mr. **Y**.

Solution (c): As the sentence is in comparative degree, so **'taller'** is the suitable word.

Example [GA – 2016 (1 mark)]: An apple costs Rs. 10. An onion costs Rs. 8. Select the most suitable sentence with respect to grammar and usage.

(a) The price of an apple is greater than an onion.
(b) The price of an apple is more than onion.
(c) The price of an apple is greater than that of an onion.
(d) Apples are more costlier than onions.

Solution (c): Options (a) and (b) convey the wrong comparison, so they are not correct. Option (c) is the correct sentence which is in the comparative degree. Option (d) has double comparative (either more or costlier can be used but not together) and so it is not correct.

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Example [GA – 2016 (1 mark)]: Choose the most appropriate set of words from the options given below to complete the following sentence. _____ _____ is a will, _____ is a way.
(a) Wear, there, their (b) Were, their, there (c) Where, there, there (d) Where, their, their
Solution (c): The actual quotation is 'where there is a will there is a way'. So option (c) is correct.

Example [GA – 2016 (1 mark)]: If I were you, I _____ that laptop. It's much too expensive.
(a) won't buy (b) shan't buy (c) wouldn't buy (d) would buy
Solution (c): If clause (type 2) is in the past tense then the main clause should be in conditional clause. Since, 'were' is in the past tense, so option (c) is the best answer.

Exercise: 1.4

Choose the most appropriate alternative from the options given to complete the given sentence.

1. **[GA-2011 (1 mark)]: _____ in the frozen wastes of Arctic takes special equipment.**
   (a) To survive (b) Surviving (c) Survival (d) That survival
2. **[GA-2011 (1 mark)]: I contemplated ____ Singapore for my vacation but decided against it.**
   (a) to visit (b) having to visit (c) visiting (d) for a visit
3. **[GA-2011 (1 mark)]: The environmentalists hope _____ the lake to its pristine condition.**
   (a) in restoring (b) in the restoration of (c) to restore (d) restoring
4. **[GA-2012 (1 mark)]: I _____ to have bought a diamond ring.**
   (a) have a liking (b) should have liked (c) would like (d) may like
5. **[GA-2012 (1 mark)]: Food prices _____ again this month.**
   (a) have raised (b) have been raising (c) have arose (d) have been rising
6. **[GA-2012 (1 mark)]: Suresh's dog is the one _____ was hurt in the stampede.**
   (a) that (b) which (c) who (d) whom
7. **[GA-2012 (1 mark)]: If the tired soldier wanted to lie down, he _____ the mattress out on the balcony.**
   (a) should take (b) should have taken (c) shall take (d) will have taken
8. **[GA-2013 (1 mark)]: The Headmaster _____ to speak to you.**
   (a) is wanting (b) wants (c) want (d) was wanting
9. **[GA-2013 (1 mark)]: Were you a bird, you _____ in the sky.**
   (a) would fly (b) shall fly (c) should fly (d) shall have flown
10. **[GA-2013 (1 mark)]: Dare _____ mistakes.**
    (a) commit (b) to commit (c) committed (d) committing
11. **[GA-2014 (1 mark)]: A person suffering from Alzheimer's disease _____ short-term memory loss.**
    (a) experienced (b) has experienced (c) experiences (d) is experiencing
12. **[GA-2014 (1 mark)]: Who _____ was coming to see us this evening?**
    (a) you said (b) did you say (c) did you say that (d) had you said
13. **[GA-2014 (1 mark)]: If she _____ how to calibrate the instrument, she _____ done the experiment.**
    (a) knows, will have (b) knew, had
    (c) had known, could have (d) should have known, would have
14. **[GA-2014 (1 mark)]: The aircraft _____ take off as soon as its flight plan was filed.**
    (a) is allowed (b) will be allowed to (c) was allowed to (d) has been allowed to
15. **[GA-2014 (1 mark)]: Communication and interpersonal skills are _____ important in their own ways.**
    (a) each (b) both (c) all (d) either
16. **[GA-2014 (1 mark)]: She will feel much better if she _____.**
    (a) will get some rest (b) get some rest
    (c) will be getting some rest (d) is getting some rest
17. **[GA-2014 (1 mark)]: She could not ____ the thought of _____ the election to her bitter rival.**
    (a) bear, loosing (b) bare, loosing (c) bear, losing (d) bare, losing
18. **[GA-2015 (1 mark)]: Dhoni, as well as the other team members of Indian team, _____ present on the occasion.**

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(a) were (b) was (c) has (d) have

19. [GA-2015 (1 mark)]: If the athlete had wanted to come first in the race, he _____ several hours every day.
(a) should practice (b) should have practiced (c) practised (d) should be practising

20. [GA-2015 (1 mark)]: We ____ our friend's birthday and we _____ how to make it up to him.
(a) completely forgot … don't just know (b) forgot completely … don't just know
(c) completely forgot … just don't know (d) forgot completely … just don't know

21. [GA-2015 (1 mark)]: The Tamil version of _____ John Abraham-starrer *Madras Café* _____ cleared by Censor Board with no cuts last week, but the film's distributors _____ no takers among the exhibitors for a release in Tamil Nadu _____ this Friday.
(a) Mr., was, found, on (b) a, was, found, at
(c) the, was, found, on (d) a, being, find, at

22. [GA-2015 (1 mark)]: Didn't you buy _____ when you went shopping?
(a) any paper (b) much paper (c) no paper (d) a few paper

23. The old general _____ us stories of how he _____ won the war alone.
(a) tell, have (b) told, have (c) told, had (d) tell, had

24. Will you do me a favour if _____ you?
(a) I want (b) somebody wants it (c) I ask (d) we all could like

25. The hijackers were arrested and didn't know where _____.
(a) they would take (b) they were being taken (c) will be taken (d) they are taken

26. A horrible morning was followed by a torrent of rain ____ afternoon.
(a) on late (b) late in (c) in late (d) late in the

27. The policeman _____ the photographer _____ too near.
(a) warns, doesn't come (b) warn, don't come
(c) warned, not to come (d) warning, shouldn't come

28. The family lost _____ money on roulette so they're unable to buy _____.
(a) their, anything (b) his, something (c) their, everything (d) his, everything

29. My daughter is only one and a half years but she _____ already _____.
(a) can, walk (b) could, walk (c) can, go (d) could, go

30. He was fined _____ the police for driving too _____.
(a) by, hard (b) from, fastly (c) from, speedy (d) by, fast

31. If you'd written earlier, I'd _____ known when you _____ to go on holiday.
(a) have, wanted (b) has, want (c) have, want (d) had, would want

32. In his spare time he _____ _____ a salesman for an insurance company.
(a) works, as (b) working, like (c) work, at (d) working, at

33. No matter _____, you must keep trying.
(a) how difficult does it seem (b) how difficult it seems
(c) however seems it difficult (d) however it seems difficult

34. After Rohan _____ in his notice at the office, his wife ran away with a lawyer.
(a) having handed (b) handing (c) had handed (d) was handing

35. Last week my neighbour _____ a serious heart attack. He _____ taken to hospital.
(a) have, had to have (b) has, has been (c) had, must had to be (d) had, had to be

36. If I _____ him before, I _____ him to my party.
(a) would have known, had invited (b) had known, would have invited
(c) would know, would invite (d) knew, didn't invite

37. We had a nice party _____ drinks and dancing; then, _____ we went home.
(a) with both, following (b) with, at least (c) both with, after all (d) with, finally

38. Could you tell me when _____ on Saturdays?
(a) shops open (b) shops' opening (c) are shops open (d) do shops open

39. The reporter asked the old lady if she has spent _____ on toys.
(a) any moneys (b) few money (c) some moneys (d) any money

40. A _____ train runs _____ than a slow train.
(a) fast, more fastly (b) fastly, much fast (c) fast, faster (d) fastly, fastlier

41. How would have drowned if she _____ swim.
(a) couldn't have (b) didn't know to (c) had not (d) hadn't been able to

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42. Only two _____ cheering wildly when the Indian pop group appeared on the stage.
(a) hundred people were (b) hundreds peoples were
(c) hundreds of peoples were (d) hundred peoples were

43. It took years of research, but _____ they found the answer.
(a) lastly (b) at the end (c) last (d) in the end

44. It was raining _____, so we couldn't go out.
(a) every days (b) all the days (c) all day (d) all days

45. While everyone else _____, she _____ quietly in the kitchen.
(a) laughed, was cried (b) was laughing, was crying
(c) was laughed, cried (d) laughed, cryed

46. He used _____ cigarettes, but he doesn't _____.
(a) to smoking, any more (b) smoking, no more
(c) to smoke, any more (d) smoke, no more

47. _____ did you say _____ called?
(a) How, you were (b) What, what were you (c) What, how were you (d) What, you were

48. The driver _____ to read a newspaper while he _____ for the lights to change.
(a) was starting, has waited (b) has started, waited
(c) started, was waiting (d) has started, has been waiting

49. _____ to the next village?
(a) What far is it (b) How long it is (c) How far is (d) How far is it

50. You _____ come tomorrow _____ you _____ something else to do.
(a) don't need, if, has (b) mustn't, iff, have (c) needn't, if, have (d) needn't to, iff has

51. The painting has taken ___ weeks to complete but this is a lot ___ the last time it was done.
(a) less, less than (b) quite a few, fewer than (c) quite a few, less than (d) less, fewer, than

52. _____ he was the cleverest in the family _____ at university he failed the most exams.
(a) While, even if (b) Even if, while (c) Although, whilst (d) Where as, though

53. By the time the administrator realized her estimate of the _____ of delegates was wrong it _____ too late.
(a) number, was (b) amount, would have been
(c) number, will have been (d) amount, will be

54. She worked hard to improve her _____ in Spanish but to hear her speak you would not think she _____.
(a) proficiently, did (b) proficiency, did (c) proficiently, had (d) proficiency, had

55. He got up early _____ walk the dog and left the house quietly _____ not to wake anyone.
(a) in order to, in such as way (b) to, so as (c) so to, as (d) so as to, so that

56. I thought _____ left the keys in the car but realized this was something I _____ normally do.
(a) its, won't (b) I'd wouldn't (c) I've, who's (d) I'm, weren't

57. I've always had an admiration _____ the work of Shyam and share with him an interest _____ travel.
(a) for, in (b) in, with (c) with, in (d) for, for

58. The session ended with the Head refusing to answer the _____ was responsible _____ the release of confidential _____.
(a) question of who, for, information. (b) question who, at, information?
(c) question, for, information. (d) who, at, information?

59. _____ sound broke the silence of the early morning and _____ felt like speaking for fear _____ breaking the magic of moment.
(a) No, no one, of (b) Not a, not any of them, from
(c) Not any, not anyone, of (d) None, nothing, from

60. I kept explaining that Delhi is _____ than Mumbai but she kept _____ further information
(a) farthest, asking for (b) farthest, asked for (c) farther, asking for (d) farther, asked for

61. In the restaurant where I work I _____ tips because I always treat _____.
(a) get often, well the customers (b) often get, the customers well
(c) get often, the customers well (d) often get, well the customers

62. That particular species of fish is found _____ the world's oceans and you can identify it from its large _____.

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(a) beneath, colourful spots (b) over, colour spot
(c) throughout, colour spots (d) across, colourful spot

63. The fact that the number of blue whales _____ increasing proves that the conservation _____ are effective.
(a) whale is, effort (b) whales are, efforts (c) whale are, effort (d) whales is, efforts

64. Kalpana Chawla was born _____ Karnal, India. She was the first Indian-American astronaut and first Indian women _____ space. She first flew _____ Space Shuttle Columbia in 1997 as a mission specialist and primary robotic arm operator. In 2003, Chawla was one of the seven crew members killed _____ Space Shuttle Columbia disaster.
(a) in, in, on, in (b) at, in, in, at (c) in, at, on, on (d) at, in, on, on

65. Paan Singh Tomar was ____ Indian soldier, athlete, and rebel. He served ____ Indian army, where his talent ____ running was discovered. He was a seven-time national steeplechase champion in the 1950s and 1960s, and represented India ____ the 1958 Asian Games.
(a) an, in, for, at (b) a, in, was, at (c) an, at, for, in (d) a, at, was, in

66. When the man noticed me, he asked me _____.
(a) some water (b) my name (c) a little food (d) how am I

67. You _____ come tomorrow if you have something else to do.
(a) mustn't (b) don't need (c) needn't (d) needn't to

68. I don't have a pen, but if I _____, I would lend it to you.
(a) will have (b) did (c) do (d) have

69. If you _____ reading the book, return it to the library, please.
(a) will have finished (b) will finish (c) had finished (d) finish

70. If he _____ to help us, we could not have finished the work in time.
(a) were refusing (b) has refused (c) wouldn't have refused (d) had refused

71. Don't blame me. I _____ him only if he hadn't been driving so fast.
(a) had followed (b) will have followed
(c) would have been able to follow (d) could follow

72. If I had been engaged to somebody else, I _____ the gift from him.
(a) wouldn't have accepted (b) won't accept (c) cannot accept (d) mustn't accept

73. If everybody _____, we could hold a meeting tomorrow.
(a) would be agreed (b) will be agreed (c) was agreed (d) agrees

74. I think those flower would grow better if you _____ them some water.
(a) have given (b) had given (c) given (d) gave

75. I know all about her new job because I _____ her for a few minutes yesterday.
(a) see (b) have been seeing (c) saw (d) have seen

76. I _____ near the house when a tile _____ off the roof. It nearly hit me.
(a) was walking, fell (b) had walked, fell
(c) walked, had fallen (d) was walking, has fallen

77. I feel _____ after all this typing.
(a) myself terribly bad (b) terribly tired (c) terribly bad (d) myself terribly tired

78. We have been waiting for you _____.
(a) since an hour (b) an hour ago (c) for an hour (d) an hour

79. I haven't seen Anita _____.
(a) since long (b) for a long time (c) in the last time (d) lastly

80. He's _____ intelligent than his sister.
(a) much less (b) lesser (c) much fewer (d) not so

81. Tell me more about you work, I'm very _____.
(a) interesting (b) interested of it (c) interested in it (d) interesting in it

82. 'Have you been to Patna?' '_____.'
(a) Still not (b) Until now not (c) Already not (d) Not yet

83. _____ to the station when I _____ you this morning?
(a) Have you gone, seen (b) Are you going, saw
(c) Were you going, saw (d) Have you been going, seen

84. As soon as I shut the front door I realised that I _____ my key _____ the house.
(a) was leaving, at (b) have left, at (c) had left, in (d) left, in

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85. About half an hour _____ I _____ Harshit.
(a) since, seen (b) ago, saw (c) before, seen (d) for, saw

86. Cats make wonderful _____ seem closer to being wild than dogs are.
(a) pets, even though, they (b) pets, even though they
(c) pets. Even though they (d) pets; even though they

87. The book had _____.
(a) a frighteningly and unhappy ending (b) a frighteningly and unhappily ending
(c) an ending that was frightening and unhappy (d) a frightening and unhappy ending

1.2.2 Grammatically Incorrect Sentence

Exercise: 1.5

In all the following questions choose the grammatically INCORRECT sentence.

1.	**[GA-2012 (1 mark)]:** (a) They gave us the money back less the service charges of Three Hundred rupees. (b) This country's expenditure is not less than that of Bangladesh. (c) The committee initially asked for a funding of Fifty Lakh rupees, but later settled for a lesser sum. (d) This country's expenditure on educational reforms is very less.
2.	**[GA-2013 (1 mark)]:** (a) He is of Asian origin. (b) They belonged to Africa. (c) She is an European. (d) They migrated from India to Australia.
3.	(a) My physician told me that I was healthy enough to run in the marathon. (b) The constitution of India certainly cannot be considered an ordinary constitution. (c) Many people believe in Aliens; however, I've never seen one. (d) Out of the nine planets in the solar system, only an Earth can sustain life.
4.	(a) Some scientists maintain that we are born with a fear of snakes. (b) Chicken pox, a virus, is very contagious. (c) Soil is the medium that supports crop plants, both physical and biologically. (d) This is the first time you have ever been to a major league baseball game, isn't it?
5.	(a) I always have a hard time getting up in the morning. (b) Companies manufacture nylon in form of fabrics, insulated coverings, and rope. (c) Which river, the Ganges or the Yamuna, is longer? (d) My best friend is moving to another city.
6.	(a) Did you hear that Ashok got a new puppy. (b) Twenty government officials met to deal with Tuesday's crisis. (c) My favourite season is spring. (d) Fossils of the North American turkey dates back to the Oligocene era.
7.	(a) That artist was originally a local government official but later had become a modest painter. (b) Be sure to thank you Aunt for the gift. (c) Colds, like many other viruses, are highly contagious. (d) Maria and I fought our way through the crowd.
8.	(a) I like to study the geography of the Himalayan region. (b) The population in recently urbanized cities around the world will increase rapid. (c) Science and Mathematics are my two best subjects. (d) A small river runs alongside the highway.
9.	(a) Ram, born in India, claimed to have psychic powers and to be capable of performing feats of telepathy. (b) I hope you will make restitution without my having to take legal action. (c) It will have been decided that the 2016 Olympic games will be held in India. (d) The noise from all the airplanes gets louder in the afternoon.
10.	(a) Put the gun down carefully.

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	(b) The person who made these delicious candied figs has my vote. (c) She and I met more than two years ago at a mutual friend's birthday party. (d) The Volga is both the primary river in Russia and the long river in all of Europe.
11.	(a) This year our company sold fewer magazine subscriptions than ever before. (b) Observations have shown that most stars in the universe are actual binary or multiple start system. (c) Yesterday, the City Fire Department responded to a blaze that had broken out at. (d) Two were arrested on a charge of vandalism that occurred at the local high school.
12.	(a) Surprisingly, my girl-friend dresses more conservatively than I do. (b) I was clearly the happiest person in the crowd. (c) In order to protect themselves and their young, opossums fall into a state of pretended collapsing. (d) The people who bought this old lamp at the auction were foolish.
13.	(a) Deers' defend territory, attract mates, and gather food with their antlers. (b) During her 60 years, she travelled to many countries in order to study the occult. (c) The cake I made last week tasted better than the one I made today. (d) It was either Karina or Katrina who brought her volleyball to the picnic.
14.	(a) Whose car will you take when you drive to their house? (b) Pulsars emit brief and extreme regular pulses or electromagnetic radiation. (c) I think Amar must have missed the bus because he is always on time for every event. (d) To find the perimeter of a polygon, add the lengths of its sides.
15.	(a) Here is one of the two books you felt in my room yesterday afternoon. (b) The policemen used a ladder to reach the kitten. (c) The most recognizably features of the giant planet Saturn are its spectacular rings. (d) Although this was an unusually dry summer, the wheat crop was not seriously damaged.
16.	(a) In engineering, fatigue is the microscopic cracking of materials, after repeating applications of stress. (b) That's the quickest way to get to Anjali's house. (c) We always have egg-curry for Sunday dinner. (d) My brother wandered sad through the streets.
17.	(a) Soon after Mona stopped to make a phone call, she realized that she had missed the bus. (b) The common housefly feeds by depositing a drop of digestive liquid on their food. (c) Neither Raj nor I heard the door open. (d) Anthony should have been here hours ago.
18.	(a) That fine circus monkey now belongs to my crew and me. (b) She and I have been enemy for more than five years. (c) Galactosemia, an inherited metabolic disorder, is caused by an enzyme deficient. (d) Although they usually has a soft body and muscular feet, some mollusks also have hard shells.
19.	(a) The words in this letter do not make sense. (b) Contrary to the popular believing, poison ivy does not spread by scratching. (c) Sunil was the most stupid person in the class. (d) Each of the students has had a half-hour conference with his or her guidance counsellor.
20.	(a) Human hearing may be damaged by listening with loud music. (b) Draw up a plan before you make you decision. (c) He drank four bottles of beer. (d) She put the puppy down carefully beside its mom.
21.	(a) I was invited, but I declined the invitation. (b) Have you ever read the book From Sex to Superconsciousness? (c) Javed Akhtar, a famous poet, has recently directed a movie. (d) Rainbows are arcs showed the colours of the spectrum, violet inside and red outside.
22.	(a) We sold fewer chocolates this year than we did last year. (b) After we sat down to eat lunch, the phone rang. (c) The horseshoe, a narrow plate usual made of iron, is attached to a horse's hoof with nails.

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	(d) The oldest one of these books is not for sale.
23.	(a) Greenhouses, enclosed glass houses used for growing plants, regulate temperature, humid, and ventilation. (b) They weren't the only ones who didn't like the presentation. (c) He shook the crumbs from the tablecloth. (d) The alarm sounded, and the fire fighters jumped into the truck.
24.	(a) There is hardly enough food for a dog. (b) Many people are aware which Central Park was built on land that was originally a sheep farm. (c) We waited while he stopped to make a phone call. (d) The main problem Arun had was too many movie tickets
25.	(a) Toadfish eggs, which are usually lay in seashells or tin cans, are guarded by the male. (b) If you are not sure, look in the dictionary. (c) Tired of running, she slowed her pace to a fast walk. (d) The committee members should work as hard as they can.
26.	(a) While she waited for the bus to arrive, Saniya sat on the bench and read her book. (b) Had we known, we would not have come. (c) During periods of turmoil, insurgents often size, hostages who are being held as guarantees. (d) When making a chocolate torte, you should use only the best ingredients.
27.	(a) When the phone rang, Sheela was writing in her journal. (b) Either solar nor hydroelectric energy will be practical in limited cases. (c) When two angles have the same degree measure, they are said to be congruent. (d) Because we stopped twice to get diesel, we arrived late.
28.	(a) Not only are marigolds attractive decorative flowers, and their scent keeps away certain pests. (b) The movie PK was as big a hit in India as it was in the U.S. (c) My dog is afraid of thunder; consequently, when there's a storm I cover his ears. (d) Beside its use in medicine, lasers have many industrial uses.
29.	(a) If they earn a B.Sc. degree, mechanical engineers are almost guaranteed a job. (b) I became ill from eating too many fried potatoes. (c) Whether they believe their clients or no, lawyers must defend them to the best of their abilities. (d) To determine the speed of automobiles, the state police often use radar.
30.	(a) Although strip mining is the cheapest method of mining, it is often harmful to the environment. (b) Along with your membership to our health club go two months of free personal training. (c) Among the castes on traditional Hindu society, the pariah are the lowest. (d) Everyone signed the petition before we submitted it to the city council.
31.	(a) We ate the popcorn while we watched the movie. (b) For the first time I understood what he was talking about. (c) All species of salmon returns from the ocean to freshwater spawning grounds to breed. (d) All the children got out their rugs and took a nap.
32.	(a) Whales and other sea mammals must emerge of the water to breathe. (b) After midnight, you will turn into a moster. (c) Have you ever visited Taj Mahal? (d) My girlfriend did not believe the story we told her.
33.	(a) My brother and I are going to see the cricket game. (b) The Russian abstract artist Malevich painted works based of geometric shapes. (c) Everyone likes Deepika, whereas I think she is sneaky. (d) I was afraid of the dark. I always slept with the light on.
34.	(a) Bats are not rodent, although they do bear a resemblance to a winged mouse. (b) Wheat are an important crop in the Indian and across the world. (c) The temperature was colder today than it was yesterday. (d) Ethics and the law having no true relationship.

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35.	(a) Should public school students be required to wear uniforms? (b) The man nodded politely, his expression bewildered. (c) Surbhi is loaded with money, so she can afford that trip to Switzerland. (d) Econometrics, a branch of economics, uses statistics to describe economic phenomenon.
36.	(a) Gossip is fun, but if it is malicious it can be hurtful, too. (b) Law enforcement agencies use a tool called profiling in certain situations. (c) The city has distributed standardized recycling containers to all households. (d) Starfishes, crinoids, sea cucumbers, and sea urchins are all examples of echinoderms.
37.	(a) There are over 1500 species of a cactus, almost all of which are native to India. (b) Many medications are extremely dangerous if swallowed. (c) Unless I buy my pistol a new licence, I will have to pay a fine. (d) The owl parrot looks like a bird of prey; however, it feeds on vegetable matter.
38.	(a) Gas in Dubai is the cheapest in the world. (b) Fewer beer is consumed per capita in India than in Pakistan. (c) Handling the boss's mail is often an important part of the secretary's job. (d) Ocean waves can vary from tiny ripples to powerful, ranging swells.
39.	(a) When I turn forty five, I will have been a coal miner for twenty years. (b) Cigarette smoke is cause of much dust in some homes. (c) Once the train arrives, we will be on our way. (d) The cashier game me two hundred sixteen dollars and sixty two cents.
40.	(a) Quartz and feldspar particles are the chief constituent of many types of sand. (b) To move freely you must be deeply rooted. (c) If I had my life to live over again, I'd dare to make more mistakes next time. (d) In 1997, scientists in Scotland were successful in cloning a sheep.
41.	(a) Apollo 11 was the first manned mission to land on the moon. (b) Wheat, oats, and barley are just little examples of important grains raised in northern India. (c) In two days, I will be the fifth person to have landed on the moon. (d) When I am sixteen, I am going to get my license.
42.	(a) Little of the world's snakes produce venom, and most venomous species live in the tropics. (b) If I were prime minister, I would make healthcare more affordable. (c) I simply cannot wait to get there! (d) My friend and I are going to go to the beach next weekend.
43.	(a) Are we going to go to the supermarket later? (b) I haven't heard from Priyanka in six months. (c) Does Sujata know when Vikas is going to arrive? (d) Many of the island of Sicily is mountainous, but there are lowlands around its coast.
44.	(a) I wouldn't have touched that button if I were you. (b) A number of species of sedge is found throughout the temperature regions of the world. (c) If he tries hard enough, Vinod could become a writer someday. (d) I just bought my sister's old house for twenty lakh rupees.
45.	(a) My dog is the fastest runner in the entire neighbourhood. (b) After today, I will have worked here for ten years. (c) Over half of the world's caloric intake are in the form of grains. (d) In five minutes, I will have been working for ten hours.
46.	(a) The old car doesn't need to be fixed. (b) My friend's house is big, red, and expensive. (c) Three species of fire ants are found in the southern India and is pests in fruit plantations. (d) She looked at him and said, 'I will be back in five minutes!'
47.	(a) Aashish went out for playing Tennis, despite his knee being hurt. (b) I wanted a drink but I was put off by the male bar. (c) The ferocious tiger that we encountered while we were lost in the jungle was surprisingly docile. (d) She hadn't eaten all day, and by the time she got home she was ravenous.
48.	(a) The superintendent had a tendency to remain stationary as the train left the platform.

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	(b) The sisters-in-laws of the bride's cousins made their way into the church. (c) Most plants, from large trees to tiny herbs, have branching roots. (d) When fishing you can always tell when you lose a fish because the line feels too.
49.	(a) The milk tasted off and I meant to complain but decided its not worth it. (b) Good mathematical ability is an excellent stepping stone to career success in jobs such as accounting or banking. (c) There are four books on the shelf: one of them is the one you want. (d) Amir Khan is my favourite actor and I really enjoy his movies.
50.	(a) Her understanding and attention span have improved greatly. (b) I willingly accepted to walk with them over the forest. (c) Rohan lives further up the hill than Mohan. (d) I will inform them of this
51.	(a) He has nothing besides what he was borne with. (b) Our school is built of bricks. (c) He walked ten miles on foot. (d) The railway department will compensate us for the loss.
52.	(a) When this was searched for, it was found. (b) I've never been to Spain. (c) I borrow my brother's car so I could for a really nice drive. (d) The food smells great.
53.	(a) I always wanted to be a singer. (b) These shoes are not big enough. (c) When I lived in India I played cricket. (d) As you gets older one better appreciates life's little comforts.
54.	(a) We'll go shopping soon. (b) Most professional athletes choose these kind of trainers. (c) We feel great sorrow when our friends abandon us. (d) It ought to be her with whom you share your secrets, not me.
55.	(a) A conjunction is used to connect words or sentences. (b) Your taking a loan to buy a car annoyed Father. (c) Between you and me, I doubt that he will come. (d) He lay among the sheets staring up at the ceiling.
56.	(a) Work that is not finished is not work at all; it is merely a botch, a failure. (b) Discount coupons will be available from tomorrow. (c) Over the years the trade federation has served their members well. (d) We went to the mall last Saturday.
57.	(a) The class concluded that the exam question was very impossible. (b) We were walking in the garden when it began to rain. (c) All I can do is to call the police. (d) My mother, who is a librarian, works a lot.
58.	(a) I meet a new acquaintance at the club today. (b) I have never seen such a beautiful garden. (c) They might have opened the window. (d) I don't like tea, either.
59.	(a) Tom suggested that Jerry should go to university. (b) Would you mind telling me your name, please? (c) He is difficult to understand when he speaks in that childish voice. (d) In my opinion, Jack is not very clever.
60.	(a) She shouldn't have broken that glass. (b) I was really surprised to find out that our house was built over 100 year ago. (c) No matter how hard he tries, he won't find it. (d) Renu asked me if I would tell her the truth.
61.	(a) I was waiting for you but you never came. (b) We were planning to have tea here.

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	(c) It is stupid to get annoyed about things that do not really matter. (d) Jane suggested that we should go to the theatre.
62.	(a) We bought a sixth packet. (b) Would you prefer me to do it? (c) She is very energetic women. (d) Foggy as though it was the sun still managed to shine through.
63.	(a) But I really did my homework! (b) Where is the book that I got for my birthday? (c) The collected datum is proving its possible after all. (d) Shall I put it in a bag?
64.	(a) As the train moved with the track the passengers jumped out of the station platform. (b) My teacher lives at Sector 16. (c) We arrived at the airport in time. (d) It rained all day yesterday, didn't it?
65.	(a) Sedimentary rocks represent one of the three main class of rocks found in Earth's crust. (b) The dinner looks good to me. (c) I don't know where he is, he hasn't arrived yet. (d) He doesn't speak languages very well.
66.	(a) He wore two different shoes to class. (b) Frustrated, Surbhi threw her pencil across the room. (c) 'Be sure to wear something comfortable,' she said. (d) As the bears ran toward us, it was growling.
67.	(a) Priyanka laughed loudly when she saw us. (b) They're looking for another apartment. (c) The first house on the street is there's (d) We set up the tent, but it soon fell over.

1.2.3 Error in Parts of a Sentence

Exercise: 1.6

Choose which of the underlined parts of the given sentence contains an ERROR.

1. [GA-2012 (1 mark)]:
No sooner had (I) the doctor seen the results of the blood test (II), than he suggested the patient (III) to see the specialist (IV).
(a) I (b) II (c) III (d) IV

2. [GA-2012 (1 mark)]:
I requested that (I) he should be given (II) the driving test (III) today instead of tomorrow (IV).
(a) I (b) II (c) III (d) IV

3. [GA-2013 (1 mark)]:
All engineering students (I) should learn mechanics, (II) mathematics and (III) how to do computation (IV).
(a) I (b) II (c) III (d) IV

4. [GA-2013 (1 mark)]:
The professor (I) ordered to (II) the students to go (III) out of the class (IV).
(a) I (b) II (c) III (d) IV

5. [GA-2014 (1 mark)]:
While trying to collect (I) an envelope from under the table (II), Mr. X fell down (III) and was losing consciousness (IV).

(a) I (b) II (c) III (d) IV

6. [GA-2015 (2 mark)]:
The student corrected all the errors that the instructor marked on the answer book.
I II III
(a) I (b) II (c) III (d) No error

7. Illiteracy is an enormous problem, it affects millions of people worldwide, and is an
I II III
impediment to social progress.
IV
(a) I (b) II (c) III (d) IV

8. If you are sure that you are in the right, and would not mind an independent examination of the
I II III IV
case.
(a) I (b) II (c) III (d) IV

9. Employees with less personal problems are likely to be more productive.
I II III IV
(a) I (b) II (c) III (d) IV

10. A census of the island revealed a population of only 10000 people.
I II III IV
(a) I (b) II (c) III (d) IV

11. Shoes of those kind are bad for the feet; low heels are better.
I II III IV
(a) I (b) II (c) III (d) IV

12. My uncle who was on vacation, along with my two cousins and I, went fishing down by the river.
I II III IV
(a) I (b) II (c) III (d) IV

13. Hopefully, we will be able to complete the building before the rainy season sets in.
I II III IV
(a) I (b) II (c) III (d) IV

14. None of us knows what the outcome of the match between India and Australia will be.
I II III
(a) I (b) II (c) III (d) No error

15. He was not merely expected to contribute funds to the project, but to work as hard as the others.
I II III
(a) I (b) II (c) III (d) No error

16. You would have to choose her, if you are looking for the best athlete to represent the school.
I II III IV
(a) I (b) II (c) III (d) IV

17. A number of trainees who take this course every year find that their knowledge of mathematics is
I II III
inadequate.
(a) I (b) II (c) III (d) No error

18. Shilpa argued vehemently with her mother over her refusal to attend the school concert.
I II III IV
(a) I (b) II (c) III (d) IV

19. The company bowed to pressure, now it has removed the offensive advertisement from the
I II III IV
hoarding.
(a) I (b) II (c) III (d) IV

20. She wondered whether the city had changed alot since she had left to go to university.
I II III IV
(a) I (b) II (c) III (d) IV

21. The last man on earth will abandon his ruined house for a cave, and his woven clothes for an
I II III
animal's skin.

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(a) I (b) II (c) III (d) No Error

22. Neither of the answers provided in the memorandum address my concerns about the validity of
I II III
the procedure.
(a) I (b) II (c) III (d) No error

23. Chetan claimed that reading classic novels is more illuminating than to read autobiographies
I II III
written by their authors.
(a) I (b) II (c) III (d) No error

24. She recounted her improbable tale with enthusiasm and in a convincing manner.
I II III IV
(a) I (b) II (c) III (d) IV

25. If you were willing to ask for directions, instead of doggedly driving on, we might get to our
I II III
destination sooner.
(a) I (b) II (c) III (d) No error

26. I have nearly written all the new tests for inclusion in the revised edition of my book, and hope to
I II III
finish the work within a week.
IV
(a) I (b) II (c) III (d) IV

27. He is not sure if he should buy the new computer now or wait until he receives his next bonus.
I II III
(a) I (b) II (c) III (d) No error

28. Mark scored poorly on the test, which is not surprising since he did not prepare adequately.
I II III IV
(a) I (b) II (c) III (d) IV

29. Was the girl who you think you saw leaving the building wearing a school's uniform?
I II III
(a) I (b) II (c) III (d) No error

30. Professor Chaturvedi's pioneering work on rainwater harvesting and recharging of groundwater in
I II
drought prone areas have been drawing media attention.
III IV
(a) I (b) II (c) III (d) IV

31. My grandmother sees remarkable well considering that she has endured four operations
I II
on her eyes and suffered from vitamin deficiency during her childhood.
III IV
(a) I (b) II (c) III (d) IV

32. The new law is too stringent; it will be neither respected or obeyed.
I II III
(a) I (b) II (c) III (d) No error

33. The tribesmen made offerings to placate the gods, whom, they believed, were angry with them.
I II III
(a) I (b) II (c) III (d) IV

34. It will be hard to soothe your mother now that you have so aggravated her by refusing to take her
I II III
eminently sensible advice.
IV
(a) I (b) II (c) III (d) IV

35. None of the present I received on my birthday this year was equally as memorable as the necklace
I II III
you gave me last year.
IV

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(a) I (b) II (c) III (d) IV

36. Many physicists initially regarded quantum theory as unnatural, absurd, and incompatible
I II
to common sense.
III
(a) I (b) II (c) III (d) No error

37. Frightened, the little boy screamed loud as his neighbour's eighty-pound dog
I II III
bounded up the sidewalk.
IV
(a) I (b) II (c) IIII (d) IV

38. Of the three girls who have recently joined the basketball team, Sunita is the taller.
I II III IV
(a) I (b) II (c) III (d) IV

39. When the professor called out his name, he walked rather hesitant to the front of the room and
I II III
stood there shaking.
IV
(a) I (b) II (c) III (d) IV

40. Watching the film, I begun to ask myself why I cared about these characters when I felt such an
I II III
intense unease.
IV
(a) I (b) II (c) III (d) IV

41. As you use them, remember that this glossary is intended to be a guide and that
I II III
nothing in it is absolute.
IV
(a) I (b) II (c) III (d) IV

42. The chief medical officer agrees that the new benefit package should include
I II III
a dental plan as well as eye care.
IV
(a) I (b) II (c) III (d) IV

43. All employees with two years' experience are entitled to full benefits, including health insurance.
I II III
(a) I (b) II (c) III (d) No error.

44. The staff at the university library deserve recognition for helping to locate the many sources
I II III
needed for the successful completion of my doctoral dissertation.
IV
(a) I (b) II (c) III (d) IV

45. Every decade, a few popular television shows transcends mere cleverness and high ratings to
I II
to reflect the social issues of our times.
III IV

46. Development of new drug often require years of testing and waiting for labelling approval from
I II III
federal regulators.
(a) I (b) II (c) III (d) No error

47. Halley's comet is a potato-shaped lump about ten miles long with a mass estimated at 10 billion
I II III
tons, most of which is water and ice.
(a) I (b) II (c) III (d) No error

48. Vanilla is currently one of the most popular of all spices and flavourings, and is found not only in

I II III
foodstuffs and also in perfumes and cosmetics.
IV

(a) I (b) II (c) III (d) IV

49. The explosions of the volcano Krakatoa in 1883 hurdled rock and ash more than 20 miles high,
I II
and it could be hear 3000 miles away.
III IV

(a) I (b) II (c) III (d) IV

50. One usually thinks of a sword as a long strip of metal, either iron or steel, with a handle, and the
I II III
first swords were made of wood.
IV

(a) I (b) II (c) III (d) IV

51. In the fifteenth century, Leonardo da Vinci suggested that defective vision can be correct by
I II
placing a lens in direct contact with the eye.
III IV

(a) I (b) II (c) III (d) IV

52. By next year the old vaudeville theatre had been converted into two small theatres in which films
I II III
can be shown.
IV

(a) I (b) II (c) III (d) IV

53. In the nineteenth century, careers in business and law were prestigious, but it did not require
I II
practitioners to hold college degree.
III

(a) I (b) II (c) III (d) No error

54. Although she considers her chemistry research complete, she has headed her professor's advice
I II
and is conducting three additional experiments.
III

(a) I (b) II (c) III (d) No error

55. His love of politics led him to volunteer in local campaigns as well as a job in a government
I II III IV
office in the state capital.

(a) I (b) II (c) III (d) IV

56. Working with consummate skill, Picasso sketched a portrait of the youthful but experienced dancer who was posing for him.

(a) I (b) II (c) III (d) No error

57. Despite the attorney's moving plea, the judge placed the juvenile offender on probation for an
I II III
indecisive period.
IV

(a) I (b) II (c) III (d) IV

58. The supervisor cited three workers, each of which is likely to win a prize for having suggested
I II III
cost-effective changes at the factory.
IV

(a) I (b) II (c) III (d) IV

59. The refusal of management to revise their policy on family leave caused an uproar among
I II III IV
employees.

(a) I (b) II (c) III (d) IV

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60. Only after the floodwaters had rose (I) two feet was the (II) mayor willing to order the (III) evacuation of some homes.
(a) I (b) II (c) III (d) No error

61. Just as (I) parents vary in their readiness to have (II) their children leave home for college, young people vary in his or her (III) readiness to leave (IV).
(a) I (b) II (c) III (d) IV

62. No matter (I) how cautious snowmobiles (II) are driven, they are capable of (III) damaging the land over which they travel (IV).
(a) I (b) II (c) III (d) IV

63. I have gone (I) to only one (II) football game after I graduated (III) from high school.
(a) I (b) II (c) III (d) No error

64. When the village elders present (I) recommendations, there is (II) hardly ever (III) any opposition against their proposals (IV).
(a) I (b) II (c) III (d) IV

65. A sweetener, normally either (I) sugar or syrup, are used (II) in almost all bread for taste (III) or as an aid to (IV) yeast growth.
(a) I (b) II (c) III (d) IV

66. Most ships move through (I) the Suez Canal under their own power (II), so extremely large ships (III) must be assisted by a tugboat.
(a) I (b) II (c) III (d) IV

67. Unlike her (I) best friend Sweety, making the varsity (II) soccer team as a freshman, Sonu did not make (III) the team until her (IV) junior year.
(a) I (b) II (c) III (d) IV

68. The Sun was shining for (I) nearly five billion years and is thought to have (II) sufficient thermonuclear fuel in its core to shine for about (III) another five billion.
(a) I (b) II (c) III (d) No error

69. The newspaper reported that (I) having the increase in the (II) minimum wage, many people are still having trouble making ends meet (III).
(a) I (b) II (c) III (d) No error

70. Because the (I) owl is usually nocturnal (II) plus being virtually (III) noiseless in flight, it is seldom seen (IV) by the casual observer.
(a) I (b) II (c) III (d) IV

71. The book is essentially (I) a detailed and very well documented (II) record of what happened to each of (III) the protestors.
(a) I (b) II (c) III (d) No error

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1.2.4 Sentence Correction

Exercise: 1.7

In all the following questions presents a sentence, part of which is underlined. Select the appropriate option in place of underlined part of the sentence.

1. **[GA-2015 (2 mark)]: Tuberculosis, together with its effects, ranks one of the leading causes of death in India.**
   (a) ranks as one of the leading causes of death (b) rank as one of the leading causes of death
   (c) has the rank of one of the leading causes of death (d) are one of the leading causes of death
2. **[GA-2015 (2 mark)]: Increased productivity necessary reflects greater efforts made by the employees.**
   (a) Increase in productivity necessary (b) Increase productivity is necessary
   (c) Increase in productivity necessarily (d) No improvement required
3. **The impostor eluded detection for so long because she conducted herself as if she was a practitioner with a license.**
   (a) as though she were a licensed practitioner (b) as though she was a licensed practitioner
   (c) like she was a licensed practitioner (d) like as if she was a licensed practitioner
4. **It ought to be her with who you share your secrets, not me.**
   (a) her with whom you share your secrets, not me
   (b) her with whom you share your secrets, not I
   (c) she with whom you share your secrets, not me
   (d) she with whom you share your secrets, not I
5. **Between you and I, I doubt that he will come.**
   (a) I, I doubt that he will come (b) I, I doubt that he would come
   (c) me, I doubt that he will come (d) me, I doubt that he would come
6. **A conjunction is used to connect words and sentences together.**
   (a) words and sentences together (b) words or sentences together
   (c) words and sentences (d) words or sentences
7. **If the gardener would sow the seeds in the greenhouse rather than the garden, he might get a better display of flowers.**
   (a) If the gardener sowed the seeds in the greenhouse rather than the garden
   (b) If the gardener were to sow the seeds in the greenhouse rather than in the garden
   (c) If the gardener would sow the seeds in the greenhouse rather than in the garden
   (d) If the gardener would sow the seeds in the greenhouse instead of the garden
8. **In the fine print at the end of the document lies the clauses that make us liable for any expenses that result from civil unrest.**
   (a) lies the clauses that make us liable for any expenses which
   (b) lies the clause that make us liable for any expenses that
   (c) lie the clauses that makes us liable for any expenses which
   (d) lie the clauses that make us liable for any expenses that
9. **It is probable that the prototype cellular motor might be ready for testing around the end of next year.**
   (a) will be ready for testing toward the end of next year
   (b) may be ready for testing about he end of next year
   (c) might be ready for testing toward next year's end
   (d) should be ready for testing toward the end of next year
10. **The Indian Human Development Index takes into account life expectancy, education, as well as income per person.**
    (a) into account life expectancy, education, as well as income per person
    (b) life expectancy, education, as well as income per person into account
    (c) into account life expectancy and education, as well as income per person
    (d) into account life expectancy, and education, and income per person
11. **India's economy continues to flourish this year: industrial production grew, inflation has eased, and the trade surplus swelled.**

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(a) has grown, inflation has eased, and the trade surplus swelled
(b) has grown, inflation eased, and the trade surplus has swelled
(c) has grown, inflation eased, and the trade surplus is swelling
(d) is growing, inflation easing and the trade surplus swelling

12. There wasn't nothing that could have been easier.
(a) There was nothing that could have been more easier
(b) Nothing could have been more easier
(c) Nothing couldn't have been more easy
(d) Nothing could have been easier

13. In classical economic theory, the relationship between supply and demand determines the price of a commodity.
(a) between supply and demand determines
(b) among supply and demand determines
(c) among supply and demand determine
(d) between supply and demand determine

14. Opposite in what many financial analysts had predicted, the stock market rose by twenty two points this month.
(a) Opposite in what many financial analysts had predicted,
(b) Contrary to the predictions of many financial analysts,
(c) As against the predictions of many financial analysts,
(d) Contrasting of many financial analysts' predictions,

15. The news reporter who had been covering the story suddenly became ill, and I was called to take her place.
(a) had been covering the story suddenly became ill, and I was called
(b) was covering the story suddenly becomes ill, and they called me
(c) is covering the story suddenly becomes ill, and I was called
(d) would have been covering the story suddenly became ill, and I am called

16. According to traditional Chinese medicine, people with healthy livers are said to be calm and that they possess unerring judgment.
(a) are said to be calm and to possess
(b) said to be calm and possessing
(c) have said to be calm and to possess
(d) are said to be calm and possessive of

17. I look forward to meeting with you and having the opportunity to show you our new products.
(a) I look forward to meeting with you and having
(b) I will look forward to our meeting and having
(c) As I look forward to our meeting and to have
(d) Looking forward to our meeting and hoping to have

18. We all arrived at the theatre on time, but before we bought our tickets, Suman says that she's changed her mind and doesn't want to see the movie after all.
(a) tells us that she had changed her mind and doesn't
(b) told us that she is changing her mind and didn't
(c) said that she had changed her mind and didn't
(d) is saying that she'd changed her mind and doesn't

19. There has been much interest in dreams throughout the ages, the empirical, scientific study of dreams is relatively new.
(a) the empirical, scientific study of dreams being relatively new.
(b) yet the empirical, scientific study of dreams is relatively new.
(c) although the empirical, scientific study of dreams is relatively new.
(d) for the empirical, scientific study of dreams is relatively new.

20. The new chairs and sofa-beds, displayed so brightly in the department store window, receives many stares from the passers-by.
(a) which are displayed so brightly in the department store window, and receives
(b) are displayed so brightly in the department store window, receive
(c) displayed so brightly in the department store window, receive
(d) being displayed so brightly in the department store window, and receiving

21. Finally rescued from the streets, the shelter provides the dogs with food and routine exercise.
(a) the shelter provides food and routine exercise to the dogs.

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(b) food and routine exercise is provided to the dogs in the shelter.
(c) the dogs are provided with food and routine exercise in the shelter.
(d) the dogs, with food and routine exercise, provide in the shelter.

22. I was surprised that, when given the news, Rohit called you and she before anyone else.
(a) you and she were called before anyone else by Rohit.
(b) Rohit called you and her before anyone else.
(c) Rohit called, before anyone else, you and she.
(d) her and you were called by Rohit before anyone else.

23. Every person feels that their needs are more crucial than that of other human beings.
(a) his needs are more crucial than that of other human beings.
(b) his needs are more crucial from that of other human beings.
(c) his needs are more crucial than those of other human beings.
(d) their needs are more crucial from those of other human beings.

24. A recent poll shows that, due to animal overpopulation concerns, dog owners had elected to spay and neuter their pets rather than let them reproduce.
(a) had elected to spay and neuter their pets instead of letting them reproduce.
(b) have elected to be spaying and neutering their pets instead of reproduction.
(c) have elected to spay and neuter their pets rather than let them reproduce.
(d) have elected to spay and neuter their pets rather than reproduction.

25. It was difficult for Surbhi to decide between writing fiction or poetry.
(a) It was difficult for Surbhi to decide between writing fiction and writing poetry.
(b) The decision to write fiction or poetry was difficult among Surbhi.
(c) It was difficult for Surbhi to decide among writing fiction or poetry.
(d) For Surbhi, between writing fiction or poetry, it was difficult to decide.

26. A partnership among two neighbourhoods, the street fair was very successful, although there was some complaints about noise levels.
(a) among two neighbourhoods, the street fair was very successful, although there will be
(b) between two neighbourhoods, the street fair was very successful, although there were
(c) between two neighbourhoods, the street fair was very successful, although there was
(d) among two neighbourhoods, the street fair was very successful, although there were

27. The web spun by orb-weaver spiders are thought to be a marvel of engineering.
(a) The webs spun by orb-weaver spiders are (b) The webs spun by orb-weaver spiders is
(c) The web spun by the orb-weaver spider are (d) The web spun by the orb-weaver spider is

28. Troubled by nightmares, Rahul is pursuing hypnosis and is hoping it will affect his dreams positively.
(a) Rahul was pursuing hypnosis and is hoping it will affect his dreams positively.
(b) Rahul is pursuing hypnosis and hopes hypnosis will affect his dreams positively.
(c) Rahul is pursuing hypnosis and hopes it will affect his dreams positively.
(d) Rahul was pursuing hypnosis and hopes it will affect his dreams positively.

29. Thrasamund's reign was longer than any other Vandal king in Africa other than his grandfather, Geiseric.
(a) than any other Vandal king in Africa other than his grandfather's reign, Geiseric.
(b) than that of any other Vandal king in Africa except his grandfather, Geiseric.
(c) than any Vandal king in Africa other than his grandfather, Geiseric.
(d) than any other Vandal king in Africa except his grandfather, Geiseric.

30. The mayor prefers a small staff over a large one, because the small staff, containing fewer people, is easier to manage.
(a) over a large one, because the small staff, containing less people
(b) over a large one, because, containing fewer people, the small staff
(c) to a large one, because the small staff, containing less people
(d) to a large one, because the small staff, containing fewer people

31. The Kakapo, a parrot native to New Zealand, is critically endangered, with under 100 living birds known, all of who are named.
(a) is critically endangered, with under 100 living birds known, all of whom are named.
(b) are critically endangered, with under 100 living birds known, all of who are named.

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(c) with under 100 living birds known, are critically endangered, all of whom are named.
(d) with under 100 living birds known, is critically endangered, all of whom are named.

32. Each of the movies were great and the choice for the best one among all three was very difficult indeed.
(a) was great and choosing the best one among the three was very difficult indeed.
(b) were great and choosing the best one between the three was very difficult indeed.
(c) was great and choosing the best one between the three was very difficult indeed.
(d) were great and the choices among all three were very difficult indeed.

33. The Navy used the nuclear submarine accident off the coast of Porbandar to show that everyone must be held responsible for their actions.
(a) to demonstrate their belief that everyone must be held responsible for their actions.
(b) to demonstrate its belief that everyone must be held responsible for their actions.
(c) to signal how no one should be able to get away with committing acts of terrible negligence.
(d) to show that everyone must be held responsible for his actions.

34. When the company went bust everyone involved lost all that they had.
(a) all that they had
(b) all
(c) all what they had
(d) what hey had

35. After the garage sale the children hadn't hardly any toys left.
(a) sale the children hadn't hardly any toys left
(b) sale the children had scarcely any toys left
(c) sail the children had hardly any toys left
(d) sale the children hadn't scarcely any toys left

36. The police hoped for help in finding the culprit and the missing money from everyone.
(a) The police hoped for help in finding the culprit and the missing money from everyone.
(b) The police hoped for help from everyone in finding the culprit and the missing money.
(c) From everyone the police hoped for help in finding the culprit and the missing money.
(d) The police hoped for help in finding the culprit from everyone and the missing money.

37. The firm is a major player in the logistics industry to play a significant role in keeping our supermarket shelves well stocked.
(a) to play a
(b) so it plays a
(c) with it playing
(d) because it plays a

38. The new government requires employers to inform an employee of their legal right to holidays and overtime pay.
(a) employers to inform employees that he has a
(b) that employers inform the employees that they have a
(c) employers to inform employees that there is a
(d) that employers inform an employee of their

39. By the end of the nineteenth century, five of the Western European states had developed a railroad system, but only one in the East.
(a) only one eastern state
(b) in the East there was only one state
(c) in the East only one state did
(d) only one in the East had

40. After the attack on the Parliament, the Prime Minister ordered intelligence agencies should prepare lists of who were India's most wanted terrorists.
(a) would do the preparation of lists of India's most wanted terrorists
(b) preparing lists of most wanted terrorists in India
(c) to prepare lists of the most wanted terrorists in India
(d) the preparing of a list of the most wanted terrorists in India

41. Forced to cut back their stock, automobile dealers in the area have cut prices; their pick-up trucks have been priced to sell, and they are.
(a) are priced to sell, and they have
(b) are priced to sell, and they do
(c) are being priced to sell, and have
(d) had been priced to sell, and they have

42. Although coffee is not usually considered a drug, it is so addictive that it has become a critical part of breakfast for many people.
(a) it is so addictive that it has
(b) it is of such addiction, it has
(c) so addicting is it as to
(d) such is its addiction, it

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43. Declining values for bonds, the financial vehicles against which investors hedge to get through the bear market, is going to force currency trading to increase.
(a) which investors use as financial vehicles to hedge against to get through the bear market, is
(b) the financial vehicle which is hedged against by investors to get through the bear market is
(c) which investors use as financial vehicles to hedge against to get through the bear market, are
(d) the financial vehicles against which investors hedge to get through the bear market, are

44. Most M.Tech. programs now mandate that potential applicants be finished with an undergraduate degree before applying.
(a) mandate that potential applicants be finished
(b) mandate potential applicants to be finished
(c) mandate that potential applicants will be finished
(d) have a mandate for a potential applicant finishing

45. The beginning of the show always brought in lots of money, yet the average singer ended the show with a decrease in what their tip may be.
(a) with what was a decrease in what their tips were able to be
(b) having decreased that which their tips might be
(c) with a decrease in tips
(d) decreasing in their tips

46. When Anupam dreams about his late wife, he sees her as she was during her youth.
(a) he sees her as she was during
(b) he sees her as she had been during
(c) he sees her as if during
(d) she appears to him as she did in

47. A cholesterol-free cake solves the problem of having a health-conscious cake to bake for a family.
(a) having a health-conscious family for which to bake a cake
(b) how to bake a cake for a health-conscious family
(c) how can one bake a cake for a health-conscious family
(d) how one could feed a health-conscious family a cake

48. The pharmaceutical company hired a consultant to supervise a division studying lower salaries as to their effects on employees' morale.
(a) for studying what are the effects in employees' morale that lower salaries would cause
(b) studying the effects of lower salaries on employees' morale
(c) studying the effects of employees' morale on lower salaries
(d) studying what the effects lower salaries would have on employees' morale

49. Eye movement occurs more rapidly during dreams than when waking.
(a) when dreaming more rapidly than waking hours
(b) more rapidly during dreaming than waking
(c) more rapidly during dreams than during the period of time when a person is awake
(d) more rapidly when dreaming than when waking

50. Two disabled children, one with crutches and the other one with a wheelchair, enters the class on Monday.
(a) the other one a wheelchair, enter
(b) the other with a wheelchair, enters
(c) the other with a wheelchair, enter
(d) one with a wheelchair, enters

51. The shipping of raw materials being improved has become an economical factor in the transformation of India into a world economic power.
(a) The improved shipping of raw materials has become an economical
(b) That the shipping of raw materials is improved has become an economical
(c) The shipping of raw materials being improved has become an economic
(d) The improvement in shipping of raw materials has become an economic

52. Factories can mass-produce beautiful glass vessels that are valued almost as much as that of the old-fashion glass-blower that remain.
(a) almost as much in value as those of the remaining old-fashioned glassblowers
(b) of a value that is almost as much as that of the old-fashioned glass-blowers that remain
(c) valued almost as much as those of the remaining old-fashioned glassblowers
(d) almost as much in value as that of the remaining old-fashioned glass-blowers

53. The incidence of rape in rural areas is equally high or more so than in urban areas.

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(a) equal to or higher than in urban areas (b) equal to, if not more, than in urban areas
(c) as high as in urban areas or more (d) as high as it is in urban areas, if not higher

54. Books to be added to the high school curriculum should be educational and should have no profanity in them or be lewd.
(a) and should not have profanity in them or not be lewd
(b) and contain no profanity or lewdness
(c) without containing profanity nor be lewd
(d) without having any profanity or no lewdness in them

55. When he could no longer play violin himself, Howard taught, imparted his knowledge to students to encourage them to be as successful as he once was.
(a) and he imparted his knowledge to students and encouraged
(b) and imparting his knowledge to students encouraged
(c) imparting his knowledge to students and encouraging
(d) imparting his knowledge to students and encouraged

56. Punk teenagers infuriate adults as much by wearing provocative clothing than by their disregard for authority.
(a) rather than by their disregard for authority (b) as by disregarding authority
(c) than by disregarding authority (d) as by their disregard for authority

57. No school policies forbid a teacher from scolding a student or to call the student's parents based only on another child's accusations.
(a) a teacher from scolding a student or to call (b) a teacher to scold a student or call
(c) scolding by teachers of a student or calling of (d) that teachers scold a student or call

58. It may be many years before politicians again attempt to revive the draft, a program known to be unpopular with voters.
(a) again attempt to revive the draft, a program known to be
(b) attempt to revive the draft again, a program known for being
(c) will attempt to revive the draft again, a program known as being
(d) attempt to revive the draft again, a program that is known to be

59. The intense humidity emphasized the fact it was, which the records show, the hottest day Delhi had ever had.
(a) it was, and it is the records that show it, (b) of it being, as the records show,
(c) shown in the records, that it was (d) that the day was, as the records show,

60. After a murderer has been convicted, it is the judge who decides whether his crime calls for executing him or imprisoning him for life.
(a) whether his crime calls for executing him or imprisoning him
(b) if there is a crime that calls for an execution or an imprisonment of him
(c) whether or not his crime calls for the execution or, imprisonment of him
(d) if there is a crime that calls for executing him or his imprisonment

61. When we visited the hospital, the doctors told us that using a walker was much easier for Grandmother than to try to walk on her own.
(a) that for Grandmother, a walker was much easier to use
(b) for Grandmother, using a walker was much easier
(c) that for Grandmother, it was much easier to use a walker
(d) for Grandmother, a walker was much easier than

62. Those watching the libel suit might speculate if the company, swift to take offense might have been as responsible for the perceived slander as the newspaper was.
(a) speculate if the company, swift to take offense had been
(b) speculate if, in its swiftness to take offense the company was
(c) wonder whether the company, swift to take offense, was
(d) wonder as to whether, in its swiftness to take offense, the company was

63. Teachers want students to be as well behaved as possible for the reason that misbehaviour on the part of students affect the learning experience of the entire class.
(a) for the reason because misbehaviour on the part of students affects
(b) because misbehaviour on the part of students affects
(c) because misbehaviour on the parts of students affects

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(d) in that misbehaviour on the part of students affect

64. Astronomical occurrences can be viewed in a religious light; many people are known to rekindle their faith after the observation of a meteor shower.
(a) many people are known to have rekindled their faith once a meteor shower has been observed
(b) there are many known people who have rekindled their faith once a meteor shower has been observed
(c) after a meteor shower is observed, there are many known people who have rekindled their faith
(d) rekindling their faith is known for many people after a meteor shower is observed

65. Although somewhat damaged, the librarians were able to read the cover of the aging tome.
(a) Although somewhat damaged, the librarians had read
(b) Damaged somewhat, the librarians were able to read
(c) Although it had been somewhat damaged, the librarians were able to read
(d) Somewhat damaged though it had been, the librarians had been able to read

66. There has been a drastic decrease in crime caused by increasing the surveillance by undercover detectives against drug dealers.
(a) decrease in crime because of increased surveillance by undercover detectives of
(b) decreasing in crime because of increasing surveillance by undercover detectives to
(c) crime decrease caused by increasing surveillance by undercover detectives against
(d) crime decrease because of increased surveillance by undercover detectives to

67. When it becomes more frequent to have parents who both earn substantial incomes, paying for children's college tuition will become easier.
(a) it becomes more frequent to have parents both earning substantial incomes
(b) it becomes more common that both parents should be earning substantial incomes
(c) it becomes more common for both parents to earn substantial incomes
(d) couples in which both of the parents earning substantial incomes become more common

1.2.5 Ordering of Words in a Sentence

Exercise: 1.8

Some parts, which are labelled as P, Q, R and S, of the following sentences have been jumbled up. Choose the correct sequence to produce the correct sentence.

1. The focus and subsequently expand our trade with the outside and develop the cooperation
P Q
is to increase agriculture and industrial production of our economic construction.
R S
(a) RSQP (b) SRPQ (c) RSPQ (d) SRQP

2. There's no without ever fumbling or faltering better juggler than a woman
P Q
between her work, family and home who has to strike a perfect balance.
R S
(a) SQPR (b) QSPR (c) SQRP (d) QSRP

3. Part of of the power generated is lost as corrupt politicians look the other way
P Q
the problem is that over a third while ingenious industrialists steal it from under their noses.
R S
(a) PRQS (b) RPSQ (c) PRSQ (d) RPQS

4. I was to see a mongoose just in time with an egg in its mouth scurrying across the grass.
P Q R S
(a) SRQP (b) QPSR (c) QRSP (d) SPQR

5. His favourite subject the secret of life and of nature because Science reveal
P Q
happens to be Science which men did not know in the past.
R S
(a) RSPQ (b) RQPS (c) PQRS (d) PSRQ

6. Climate cultures and political structures in that it affects the entire
   P Q
   change is a truly unifying phenomenon world irrespective of national borders.
   R S
   (a) RSQP (b) PSQR (c) RQSP (d) PQSR
7. We met this evening on our way home Mr. and Mrs. Goyal
   P Q R
   and asked them if they would be free.
   S
   (a) QRPS (b) PQRS (c) RQSP (d) RQPS
8. after his arrival immediately he began to quarrel with his wife.
   P Q R S
   (a) QRSP (b) PQRS (c) QPRS (d) RQSP
9. the man made a complaint at the police station whose cycle was stolen.
   P Q R S
   (a) PQRS (b) PRSQ (c) PSQR (d) RPQS
10. Nobody in the house was kept where the key seemed to know to the main door.
    P Q R S
    (a) RQPS (b) QPRS (c) SQPR (d) RQSP
11. She introduced me at the party I had met to a man the previous night.
    P Q R S
    (a) RPQS (b) RQPS (c) SPRQ (d) PQRS
12. Whether the plan depends on how it suggested will succeed or fail interested in its progress
    P Q R
    will be received by these.
    S
    (a) SRPQ (b) QPSR (c) PQRS (d) RSQP
13. If in their daily lives the people of our country and never deceive one another
    P Q
    always speak the truth then our prestige will be great.
    R S
    (a) PRQS (b) RQPS (c) SPQR (d) PQRS
14. For us before this Monday to complete this work and it should not be delayed
    P Q R
    is very important.
    S
    (a) PQRS (b) QPSR (c) RSPQ (d) QSPR
15. When he had ridden to the end of his mad little journey in front of his rocking horse
    P Q
    he climbed down and stood staring fixedly into its lowered face.
    R S
    (a) QRPS (b) SQPR (c) PRQS (d) PSRQ
16. The gardener with a little brown moustache a short fellow and sharp little brown eyes
    P Q R
    tiptoed into the room.
    S
    (a) PQRS (b) QPRS (c) QPSR (d) QSRP
17. I realised more than ever and how we lived and worked.
    P Q
    how cut off we were from our people and agitated in little world apart from them.
    R S
    (a) QSPR (b) SQRP (c) PRQS (d) RSQP
18. as the marketing and distribution of drugs to eradicate the menace of drug addiction
    P Q
    it has become increasingly problematic generates huge illegal profits.

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R S

(a) RQPS (b) PSQR (c) PRQS (d) PSRQ

19. Even today many superstitions exists by a great many people and are believed in
P Q R

among the most civilised nations.
S

(a) SPRQ (b) PSQR (c) SQPR (d) QPRS

20. from behind a curtain he held it in such a manner bringing the light
P Q R

that it fell slantwise on her face.
S

(a) SQRP (b) RPQS (c) SPQR (d) SRPQ

21. Our society today that people have lost their frankness is so fragmented
P Q

and the art of conversation seems to be disappearing fast.
R S

(a) QPRS (b) PQSR (c) QSPR (d) RSPQ

22. For thirty years with slave like docility or her tribe his wife submitted to his persecution
P Q R

that is the badge.
S

(a) RQPS (b) PRQS (c) RPSQ (d) RPQS

23. He was known and therefore his arrest surprised everyone who knew him
P Q

on charges of corruption to be an honest and kind man.
R S

(a) SPRQ (b) RQPS (c) PQRS (d) QRPS

24. I had been staying with at his cottage among the Yorkshire fells a friend of mine
P Q

a delightfully lazy fellow some ten miles away from the railway station.
R S

(a) PQRS (b) QRPS (c) QRSP (d) RQPS

25. I am sure and will be happy sooner or later a day will come when all will be equal.
P Q R S

(a) QPRS (b) QSRP (c) RQSP (d) RSQP

26. the teacher had to be specially careful because he enjoyed the confidence
P Q

about how he faced up to this problem of all the boys.
R S

(a) PRQS (b) QPSR (c) SPRQ (d) PSRQ

27. Fame by showing off to the best advantage one's ability and virtue is earned.
P Q R S

(a) PQRS (b) SPRQ (c) PRSQ (d) PQSR

28. The general line about television is that it is very exciting
P

but also potentially very dangerous immensely powerful that I took myself.
Q R S

(a) PQRS (b) SPRQ (c) PRQS (d) RPQS

29. It is foolish of those who posses them to believe that will result in victory
P Q R

the use of nuclear weapons.
S

(a) RSPQ (b) QSRP (c) PRQS (d) SQPR

30. The budget with high expectations by all types of taxpayers of tax relief is being awaited.

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P Q R S

(a) PRQS (b) QPRS (c) RPSQ (d) SPRQ

31. The scientist refused to talk to the press who discovered that everyone is talking about
P Q R
the ancient cure.
S

(a) QRPS (b) RSPQ (c) QSRP (d) PRSQ

32. The prevention of disease facing the authorities was by far after the earthquake
P Q R
the most urgent problem.
S

(a) QSPR (b) RPQS (c) QRPS (d) SPRQ

33. The extent of social progress in various nation building activities is an important indicator
P Q R
of women's participation.
S

(a) PRSQ (b) SQRP (c) RSQP (d) QPRS

34. At last had come she had been the moment waiting for.
P Q R S

(a) RQSP (b) QSPR (c) SQRP (d) QRPS

35. The judge lied to the court why he had asked the accused in-spite of his oath.
P Q R S

(a) PSRQ (b) QPSR (c) PRQS (d) RQPS

36. All the students affirmed positively that responded eagerly to the question and
P Q
the political affiliation of student unions interviewed on television was undesirable.
R S

(a) PQRS (b) SRPQ (c) RPQS (d) SQPR

37. I have read who by some mysterious laws of her nature
P
in the form of a foul and poisonous snake the story of a fairy
Q R
was condemned to appear in certain seasons.
S

(a) QRSP (b) PQRS (c) RQPS (d) RPSQ

38. The principal has issued a notice will have to vacate the hostel that those junior doctors
P Q
if they fail to join duty by Monday next who are participating in the strike.
R S

(a) QSPR (b) RQSP (c) PRQS (d) QRSP

39. that he sought my advice to such an extent even in private domestic matters
P Q R
I won his confidence.
S

(a) QRSP (b) QPRS (c) RQSP (d) SQPR

40. The rising prices out of gear have thrown important industries many of our.
P Q R S

(a) SRQP (b) RSPQ (c) QPSR (d) QPRS

41. It in the news bulletin did not feature that this matter was surprising.
P Q R S

(a) PSQR (b) RQPS (c) QSPR (d) SRQP

42. It must not be imagined that a walking tour, is merely a better or worse way
P Q
as some would say of seeing the country.
R S

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(a) RPQS (b) PRQS (c) PQSR (d) PQRS

43. We agreed with the manner in which you said it but we objected to what you said.
P Q R S

(a) PSQR (b) SPQR (c) SPRQ (d) PSQR

44. All religions are to advance the cause of peace in a holy partnership justice and freedom
P Q R
bound together.
S

(a) PQRS (b) PRQS (c) SPQR (d) SQPR

45. Just as the goodness of movies like the things which they represent, does not consist in being
P Q
so the goodness of music does not consist in its being like the noises we know.
R S

(a) QPRS (b) PQRS (c) RPSQ (d) SPRQ

46. When he knew he sat down under a tree about what to do next and thought for a long time
P Q R
that there was no more hope.
S

(a) SRQP (b) SPRQ (c) QPSR (d) RSPQ

47. When the driver in front of me on slammed the brakes I was driving in rush hour
P Q R
without warning.
S

(a) PQSR (b) RSQP (c) RPQS (d) PQRS

48. Some educationists should not be exposed to believe that young children
P Q R
too much television viewing.
S

(a) RSPQ (b) QPRS (c) QRPS (d) PQRS

49. My friend when he was going to his office met with an accident on his scooter
P Q R
due to rash driving.
S

(a) PQRS (b) PRQS (c) SRQP (d) QSPR

50. All religions are to advance the cause of peace in a holy partnership justice and freedom
P Q R
bound together.
S

(a) PRQS (b) PQRS (c) SQPR (d) SPQR

51. From since the flaw affected so few users a technical standpoint,
P Q
that there was no need to replace all flawed chips logic and reason would argue.
R S

(a) QSPR (b) SQRP (c) SQPR (d) QSRP

52. It has where strong minds have also been a cricket tour into delivering one more effort
P Q R
whipped tired bodies.
S

(a) QRSP (b) SPQR (c) QPSR (d) SRQP

53. The delay that even five hours later there was no proper estimate
P
meant that not only did the monster tsunami wave
Q
of the true magnitude of the grave tragedy strike without warning but.

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R S

(a) RSPQ (b) QPSR (c) RPSQ (d) QSPR

54. In a tennis world no shot of Roger Federer to the next that swears by repetition
P Q R
bears resemblance.
S

(a) RPSQ (b) QSPR (c) RSPQ (d) QPSR

55. The census when they were released in 2001 as they
P
imbalance in the child sex ratio (CSR) against girls
Q
of India's provisional results caused alarm showed a continuing trend in the serious.
R S

(a) QSPR (b) RPSQ (c) QPSR (d) RSPQ

56. The Indian nuclear electricity generation capacity in the country
P
with a total installed capacity of 3.310MW,
Q
power programme currently consists of 15 operational reactors
R
amounting to about 3% of total installed.
S

(a) SQRP (b) RPSQ (c) SPQR (d) RQSP

57. Even the underbelly of the city's crumbling health infrastructure too attacks that also reveal
P Q
as the city's urban infrastructure crumbles it is these increasing cases of canine.
R S

(a) QPRS (b) RSQP (c) QSRP (d) RPQS

58. Over the past five decades but the post cold war era brings new challenges to the UN
P
particularly its peacekeeping operations for which demand has increased sharply
Q
in even area of the United Nations Charter international cooperation has brought advances.
R S

(a) PQSR (b) SRPQ (c) PRSQ (d) SQPR

59. Unaware reading others periodicals and publications ourselves with merely
P Q
of the need to build the intellect we tend to entertain.
R S

(a) QPRS (b) RSQP (c) QSRP (d) RPQS

60. Loss of employment in a country like India where is no social security net to fall back on
P Q
most people are still poor and there or livelihood can be really injurious.
R S

(a) SRPQ (b) QPRS (c) QRPS (d) SPRQ

61. Being to a viewing point a higher more expansive place to more from a point of view
P Q
willing to change allows you from which you can see both sides.
R S

(a) RQPS (b) QRPS (c) QRSP (d) RQSP

62. The greatest miss it but that it is too danger for most of us
P Q
is not is not that our aims too high and we low and we reach it.
R S

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(a) QSPR (b) PRQS (c) QRPS (d) PSQR

63. Finding me absent for the purpose of stealing my watch there a lad of thirteen
P Q
the servant of my neighbour entered my bedroom.
R S

(a) QRSP (b) QRPS (c) RQPS (d) RQSP

64. Freedom implies not only emancipation from equal distribution of wealth but also
P Q R
political bondage.
S

(a) PQRS (b) PSRQ (c) SPRQ (d) QPRS

65. The judge who wanted a long date in the case of the defence lawyer turned down the request
P Q R
when he was in his chamber.
S

(a) RQSP (b) PRQS (c) SRQP (d) RPQS

Answers

Answer Keys: Exercise: 1.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	c	d	c	b	c	d	c	a	a	c	a	d	c	c	d	a	a	b
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
a	c	c	c	c	c	c	a	d	c	d	d	d	b	d	d	c	c	d	c
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
d	b	d	d	d	d	c	a	a	b	d	d	d	d	d	c	d	d	b	c
61	**62**	**63**	**64**	**65**															
d	d	b	a	d															

Answer Keys: Exercise: 1.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	d	b	b	a	b	c	b	a	a	b	d	c	b	a	b	a	b	c	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
b	b	d	c	b	b	d	a	a	d	a	c	a	a	c	b	b	a	d	d
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	b	c	d	c	a	a	b	d	b	c	d	a	c	c	b	c	c	a	c
61	**62**	**63**	**64**	**65**															
d	d	c	b	c															

Answer Keys: Exercise: 1.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	d	a	a	c	a	b	c	b	c	d	a	c	d	a	d	c	d	d	a
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
b	d	d	d	a	a	c	b	c	b	b	a	d	a	a	d	a	b	b	c
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	d	a	c	d	a	a	c	a	b	c	b	b	b	a	b	d	c	c	a
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**											
a	b	a	b	b	a	a	a	d											

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Answer Keys: Exercise: 1.4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	c	c	d	a	a	c	a	a	c	b	c	c	b	b	c	b	b	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
c	a	c	c	b	d	c	a	a	d	a	a	b	c	d	b	d	a	d	c
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
d	a	d	c	b	c	d	c	d	c	c	c	a	d	b	b	a	a	a	c
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
b	c	d	a	a	b	c	b	d	d	c	a	d	d	c	a	b	c	b	a
81	**82**	**83**	**84**	**85**	**86**	**87**													
c	d	d	c	b	b	d													

Answer Keys: Exercise: 1.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	c	d	c	b	d	a	b	c	d	b	c	a	b	c	a	b	c	b	a
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
d	c	a	b	a	c	b	a	c	c	c	a	b	b	d	d	a	b	b	a
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	a	d	b	c	c	b	d	a	b	a	c	d	b	d	c	a	a	c	b
61	**62**	**63**	**64**	**65**	**66**	**67**													
c	d	c	a	a	d	c													

Answer Keys: Exercise: 1.6

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	b	d	b	d	b	a	c	a	d	a	c	a	d	a	a	d	c	b	b
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
d	b	c	d	d	a	a	c	a	d	a	c	b	b	c	c	b	d	c	b
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	b	d	b	b	c	d	d	c	c	b	a	b	d	d	d	d	b	b	A
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**									
c	b	c	d	b	c	b	a	b	c	d									

Answer Keys: Exercise: 1.7

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	a	a	c	d	b	d	a	c	d	d	a	b	a	a	a	c	b	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
c	b	c	c	a	b	d	c	b	d	a	a	d	a	b	b	b	c	d	c
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	a	d	a	c	a	b	b	c	c	d	c	d	b	c	b	b	a	d	a
61	**62**	**63**	**64**	**65**	**66**	**67**													
c	c	b	a	c	a	c													

Answer Keys: Exercise: 1.8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
b	d	d	c	a	b	c	c	c	d	b	b	a	b	c	b	c	b	a	b
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
a	c	a	b	c	a	b	b	b	d	c	a	b	a	d	d	d	a	d	c
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
d	b	d	d	a	b	c	c	b	c	d	c	d	a	b	d	b	b	b	d
61	**62**	**63**	**64**	**65**															
a	c	d	b	c															

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Chapter 2 : Vocabulary

2.1 Synonyms and Antonyms

A synonym is a word or phrase that means exactly or nearly the same as another word or phrase. On the other hand, an antonym is a word or phrase that means exactly or nearly the opposite as another word or phrase. The exactly meaning, synonym and antonym for some common words are given as:

Word	Meaning	Synonym	Antonym
Abandon	To give up completely	Relinquish, Forsake	Restraint
Abash	To lose self-confidence	Fluster, Discompose	Self-possessed
Abdicate	To give up claim to	Renounce, Abandon	Keep, Assert
Abet	To encourage or support	Spur, Incite	Deter
Abridge	To shorten	Curtail, Diminish	Protract, Elongate
Abrogate	To abolish or render void	Annul, Nullify	Approve, Enact
Abstemious	Moderate in the use of food or drink	Temperate	Gluttonous, Hungry
Academic	Pertaining to school or college	Scholastic	Ignorant, Ordinary
Accede	To agree to	Assent	Demur
Accelerate	To quicken, speed tip	Expedite	Retard
Accolade	An award or salute	Tribute, Ovation	Admonition
Accord	Agreement or Harmony	Concord, Concurrence	Dissension, Discord
Acrimonious	Sharp or harsh in language	Caustic, Acerb	Suave, Affable
Acumen	Keenness of mind or insight	Acuity, Awareness	Ignorance
Admonish	To warn or find fault gently	Chide, Caution	Allow, Compliment
Adversary	An opponent	Antagonist	Cohort, Confederate
Adversity	Misfortune	Affliction, Mischance	Assistance
Aesthetic	Pertaining to the beautiful	Artistic, Creative	Displeasing, Ugly
Affable	Sociable, Courteous	Civil, Complaisant	Curt, Brusque
Affluent	Prosperous, Flourishing	Opulent, Profuse	Destitute
Aggressive	Attacking, Offensive	Bumptious, Officious	Meek, Humble
Alacrity	Eagerness	Celerity, Briskness	Apathy
Alienate	To estrange	Disaffect, Divide	Combine, Join
Allay	To calm	Appease, Alleviate	Intensify, Aggravate
Allude	To refer to indirectly	Insinuate, Intimate	Refer, Cite
Allure	To tempt by flattery	Lure, Decoy	Repel
Ambiguous	Uncertain, Vague	Hazy, Obscure	Certain, Clear
Amenable	Obedient	Tractable, Docile	-
Amiable	Good-natured	Complaisant	Aloof, Repulsive
Analogy	A partial similarity	Comparison, Parallel	Anomaly
Anarchy	State of confusion or lawlessness	Chaos, Pandemonium	Calm, Harmony
Animus	A feeling of hatred	Enmity, Animosity	Amity
Annals	Historical records	Journal, Archives	-
Anonymous	Of unknown authorship	Nameless, Unidentified	Known, Identified
Anthology	A collection of choice literary works	Album, Compendium	-
Antithesis	Contrast; the direct opposite	Antipode, Contrary	Same, Similarity
Apathy	Lack of feeling or interest	Torpor, Lethargy	Zeal, Animation
Apprehensive	Fearful	Afraid, Concerned	Calm, Certain
Apprise	To inform	Advise, Brief	Conceal, Hide
Approbation	Approval	Sanction, Consent	Denial, Disfavour
Archetype	An original pattern	Prototype	Stereotype, replica
Arid	Dry	Jejune, Parched	Arable, Fertile
Aristocracy	Government by the best people	Oligarchy	Democracy

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Word	Meaning	Synonym	Antonym
Armistice	A temporary suspension of hostilities	Truce	Dispute
Artful	Crafty	Cunning, Wily	Guileless, Ingenuous
Articulate	To speak clearly or distinctly	Coherent, Eloquent	Inarticulate, Unclear
Ascetic	Rigorously self-denying	Austere, Abstinent	Wanton
Askance	With distrust	Suspiciously	-
Asseverate	To declare positively	Assert, Avouch	Gainsay, Controvert
Assiduous	Industrious	Sedulous, Attentive	Indolent, Slothful
Asylum	Place offering shelter and retreat	Sanctuary, Refuge	Danger
Atheist	One who denies that God exists	Infidel, Agnostic	Believer
Attribute	Assign	Ascribe	Aspect, Quality
Augment	To increase or enlarge	Enhance, Amplify	Abate, Curtail
Auspicious	Indicating a happy outcome	Propitious, Fortunate	Ominous, Foreboding
Authentic	Genuine	Veritable	Apocryphal
Autocratic	Despotic	Tyrannical	Benevolent
Avarice	Excessive greed	Covetousness, Cupidity	Magnanimity
Awry	Unsymmetrical	Askew	Ok
Banal	Lacking in freshness	Commonplace	Racy, Original
Baneful	Destructive, Poisonous	Deleterious, Pernicious	Beneficent
Banter	Good-natured teasing or ridicule	Raillery, Chaff	Chitchat, Gossip
Baton	A stick or staff	Cudgel, Mace	-
Belie	To give a false idea of	Misrepresent	Approve, Affirm
Bellicose	Inclined to quarrel	Pugnacious, Contentious	Pacific, Conciliatory
Belligerent	Engaged in war	Aggressive, Hostile	Agreeable, Calm
Benevolent	Kindly, Charitable	Benign, Benignant	Malevolent
Bereave	To deprive desolate by loss	Dispossess, Divest	Clothe, Cover
Besmirch	To soil or dirty	Smirch, Defile	Honour, Praise
Biased	Prejudiced	Bigoted, Arbitrary	Disinterested
Bibliophile	A lover of books	Intellectual, Savant	-
Bizarre	Unusual in appearance	Odd, Fantastic	Common, Normal
Bland	Gentle, Polite	Mild, Suave	Piquant, Tart
Blandishment	A flattering speech or act	Adulation, Cajolery	Criticism
Blemish	To scar or spoil	Blot, Blotch	Blank, Clarity
Blight	To ruin or decay	Wither, Blast	Cleanliness
Blithe	Joyous, Merry	Carefree, Jaunty	Depresses, Worried
Bog	A swamp	Morass, Fen	-
Bombastic	High-sounding	Ranting, Pompous	Humble, Quiet
Boorish	Unrefined in speech or manners	Churlish, Uncouth	Suave
Bucolic	Pertaining to the country	Pastoral, Rustic	-
Buffoon	A clown	Harlequin	-
Bulwark	An embankment used as a fortification	Rampart	Harm, Hurt
Bumptious	Obnoxiously conceited or self-assertive	Aggressive, Arrogant	Humble, Uncertain
Cabal	A small group of persons engaged in plotting	Conspiracy	-
Cacophonous	Un-harmonious sounding	Dissonant, Discordant	Mellifluous
Cadaverous	Corpselike	Ghastly, Gaunt	Rubicund, Florid
Callous	Unfeeling or insensitive	Insensible, Obdurate	Caring
Calumniate	To accuse falsely in order to injure another's reputation	Asperse, Vilify	Compliment

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Word	Meaning	Synonym	Antonym
Candid	Frank, Outspoken	Artless, Ingenuous	Guileful, Evasive
Cantankerous	Ill-natured	Petulant, Peevish	Amiable, Affable
Capricious	Inclined	Fickle, Fitful	Steadfast, Constant
Captious	Quick to find fault about trifles	Hypercritical, Carping	Commendatory
Castigate	To punish or criticize severely	Reprove, Upbraid	Commend, Eulogize
Celestial	Pertaining to the sky	Ethereal, Devine	Earthly
Chauvinist	An extreme patriot	Jingoist	-
Chicanery	Trickery, Deception	Duplicity, Craft	Honesty
Chronic	Continuing a long time	Persistent, Unremitting	Intermittent
Circumspect	Cautious	Prudent, Vigilant	Rash, Indiscreet
Circumvent	To gain an advantage by the use of trick	Thwart, Balk	Aid, Assist
Civil	Of or having to do with citizens or the state	Respectful, Gracious	Foreign, Impolite
Clamorous	Loud and noisy	Vociferous, Obstreperous	Muted, Quiet
Clandestine	Secret, Stealthy	Furtive, Covert	Overt, Manifest
Clement	Merciful, Gentle	Compassionate, Forbearing	Relentless, Ruthless
Coalition	Merging of various units into one unit	Amalgamation, Consolidation	Detachment, Division
Coercion	Use of force or intimidation to obtain compliance	Constraint, Restraint	-
Cogent	Having the force to compel	Compelling	Ineffective
Collusion	Working together secretly for an evil purpose	Collaboration, Conspiracy	Honestly
Commodious	Roomy	Spacious, Capacious	Convenient
Compatible	Harmonious	Congruous, Consistent	Incongruous
Compendium	A brief summary of the main ideas of a larger work	Synopsis, Digest	Un-abridgement
Compensation	Payment for services	Stipend, Remuneration	Debt, Hurt
Complacent	Self-satisfied	Smug	Unhappy
Compunction	Regret for wrongdoing	Contrition, Penitence	Disdain
Concede	To yield	Acquiesce, Capitulate	Defend, Deny
Condign	Well-deserved	Deserved, Good	Immoral, Unjust
Condole	To express sympathy with another in sorrow	Commiserate	Agitate, Distress
Condone	To forgive or overlook	Extenuate, Palliate	Attend, Deny
Confederate	A person allied with others for a special purpose	Collaborator, Accomplice	-
Congenial	Possessing similar interests and tastes	Compatible	Aloof, Cold
Conjecture	To guess	Surmise, Presume	Proof, Reality
Consecrate	To set apart as sacred	Hallow, Sanctify	Desecrate
Consensus	General agreement	Accord	Denial, Dissension
Consternation	Amazement	Dismay, Bewilderment	Assurance, Beauty
Construe	To interpret	Define, Infer	Misunderstand
Consummate	Perfect or highly accomplished	Accomplished, Gifted	Inept, Poor
Contemptuous	Expressive of contempt	Supercilious, Scornful	Flattering, Humble
Convivial	Festive	Jovial, Jocund	Lugubrious
Copious	Plentiful	Profuse, Bountiful	Meagre, Scant

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Word	Meaning	Synonym	Antonym
Corpulent	Fat	Obese, Portly	Gaunt, Lank
Cosmopolitan	One who is at home in all countries	Catholic	Parochial, Provincial
Countenance	A face	Visage	-
Crass	Coarse and stupid	Gross	Nice, Polite
Craven	Coward	Poltroon	Stalwart, Intrepid
Credence	Trust or belief	Assurance	Denial
Credible	Worthy of belief	Honest, Plausible	Deceptive
Creditable	Deserving or reflecting credit or honour	Praiseworthy, Meritorious	Discreditable, Infamous
Credulous	Inclined to believe anything	Gullible	Incredulous
Cringe	To shrink in fear	Cower, Flinch	Face, Meet
Crucial	Decisive or critical	Compelling, Decisive	Inessential, Minor
Cryptic	Containing hidden meaning	Occult, Enigmatic	Palpable, Manifest
Culpable	Deserving blame or censure	Censurable	Irresponsible
Cumbrous	Burdensome and clumsy	Cumbersome	-
Cursory	Hurried	Random, Sketchy	Careful, Detailed
Cynical	Sneeringly distrustful of the good motives	Sarcastic, Surly	Believing, Hopeful
Dearth	Scarcity	Absence, Deficiency	Abundance
Deference	Submitting to the wishes of another	Respect, Complaisance	Recalcitrance
Deity	A god	Divinity, Idol	-
Delectable	Very pleasing	Expunge, Censor	Distasteful
Delineate	To sketch or portray	Define, Depict	Confuse, Distort
Delinquent	An offender	Derelict	Early, Paid
Deluge	A great flood	Avalanche, Barrage	-
Demure	Affectedly or falsely modest or prim	Sedate, Staid	Immodest, Frivolous
Denounce	To speak against	Stigmatize, Censure	Laud, Eulogize
Deplete	To empty or to use up	Exhaust, Drain	Replenish
Deplore	To express sorrow or grief over	Lament, Decry	Approve, Commend
Depraved	Of low morals	Debased, Wicked	Clean, Descent
Deprecate	To plead against a certain course of action	Remonstrate, Protest	Sanction
Depreciate	To belittle or speak slighting	Disparage, Derogate	Enhance, Magnify
Devastation	Widespread ruin	Destruction	Construction
Devious	Winding, Indirect	Circuitous	Frank, Honest
Devoid	Lacking in	Destitute	Abounding
Devout	Devoted to religious observances	Pious, Religious	Impious
Dictum	Art authoritative statement	Adage, Aphorism	-
Didactic	Designed to teach	Pedagogical	-
Diffident	Lacking in self-confidence	Shy, Timid	Forward, Aggressive
Dilemma	A difficult or perplexing situation	Quandary, Plight	Good Fortune
Dilettante	One who dabbles in the fine arts for amusement only	Amateur, Tenderfoot	Professional
Disconcert	To confuse	Perturb, Discomfit	Aid, Assist
Disconsolate	Depressed	Inconsolable	Blithesome
Discourse	To converse or talk	Monologue, Essay	Quiet, Silence
Discrete	Separate	Disconnected, Distinct	Connected, Similar
Discursive	Rambling from one subject to another	Desultory, Digressive	-
Disparity	Inequality	Discrepancy	Agreement

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Word	Meaning	Synonym	Antonym
Dispassionate	Free from feeling or partiality	Palm, Impartial	Partial
Dispatch	To do speedily	Expedite	Delay, Rest
Dispel	To drive away	Dissipate, Disperse	Accept, Collect
Dissent	To disagree	Discord, Disunity	Acceptance
Dissolute	Living loosely	Debauched	Chaste, Moral
Distraught	Mentally distressed	Harassed	Balanced, Calm
Diverse	Varied	Multifarious	Like, Similar
Diverting	Entertaining	Distracting	-
Divulge	To make public or reveal	Disclose, Impart	Conceal, Cover
Dogmatic	Positive in expressing an opinion	Overbearing	Ambiguous
Dolorous	Sorrowful	Doleful, Lugubrious	Jocund, Blithe
Dynamic	Forceful	Energetic	Static, Inert
Ecclesiastic	Pertaining to the clergy or the church	Abbot, Chaplin	-
Edict	A public command or proclamation issued by an authority	Decree	Request
Edify	To instruct or uplift, particularly in morals or religion	Enlighten, Uplift	Learn
Effete	No longer productive	Corrupt, Debased	Capable
Egotistic	Conceited	Egocentric, Vain	Altruistic
Egregious	Outstandingly bad an egregious mistake with serious implications	Atrocious, Deplorable	Concealed, Good
Ejaculate	To exclaim or utter suddenly	Climax, Spurt	-
Elicit	To draw out	Evoke, Extract	Placate, Soothe
Elucidate	To make clear	Clarify	Cloud, Confuse
Emissary	A person sent on an errand or mission	Envoy, Messenger	-
Engender	To cause, produce, or stir up	Arouse, Beget	Calm, Destroy
Ensue	To follow or result	Arise, Befall	Cause, Cease
Entreat	To beg earnestly	Solicit, Supplicate	Allow, Answer
Ephemeral	Very short-lived	Fleeting, Transitory	Eternal
Epicurean	A person devoted to luxurious living and pleasure	Gourmet, Libertine	-
Epigram	A brief pointed saying	Aphorism	-
Epitaph	A tombstone inscription	Elegy, Eulogy	-
Epithet	A phrase that describes a quality (good or bad) in a person or thing	Characterization , Appellation	-
Err	To be mistaken or go astray	Stray, Blunder	Behave, Obey
Erratic	Irresponsible, eccentric	Abnormal, Arbitrary	Calm, Common
Erudite	Learned	Scholarly, Knowing	Uneducated
Esoteric	Understood by only a select few	Abstruse, Recondite	Common
Exceptionable	Objectionable	Questionable	Laudable
Exculpate	To free from blame	Vindicate, Exonerate	Arraign, Indict
Exemplary	Serving as a model	Illustrative, Typical	Unworthy, Poor
Exodus	A going out	Departure, Emigration	Stay, Arrival
Exotic	Of foreign origin	Alien, Alluring	Boring
Expatiate	To speak or write at great length	Dilate	Compress
Expatriate	To banish or exile	Emigrant, Evacuee	-
Expedient	Convenient in helping to attain some purpose	Opportune, Seasonable	Unfeasible
Exploit	To use for one's selfish purpose	Feat	Failure
Expound	To set forth in detail	Clarify, Express	Complicate
Expurgate	To amend by removing words	Purge	Dirty, Open

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Word	Meaning	Synonym	Antonym
Extemporaneous	Done or spoken on the spur of the moment	Impromptu, Offhand	Deliberate, Planned
Extinct	No longer existing or active	Defunct	Extant
Extirpate	To root out	Eradicate, Exterminate	Bear, Build
Extraneous	Not essential	Extrinsic, Adventitious	Germane, Intrinsic
Exultation	Great rejoicing	Jubilation	Depression, Gloom
Facetious	Given to joking or inappropriate gaiety	Jocose, Droll	Solemn, Grave
Fallacious	Unsound	Beguiling, Delusive	Correct, Real
Fallible	Liable to make mistakes or be deceived	Faulty, Frail	Perfect, Strong
Fathom	To penetrate and understand	Appreciate, Divine	Misinterpret
Fatuous	Foolish, Silly	Absurd, Dense	Aware, Bright
Fealty	Faithfulness	Allegiance, Constancy	Disloyalty, Infidelity
Feasible	Workable	Achievable	Impracticable
Feign	To pretend	Dissemble, Sham	Be honest
Felicity	A state of happiness	Bliss	Depression, Lack
Fervid	Spirited	Perfervid, Impassioned	-
Festoon	A garland of flowers, leaves	Adorn, Drape	-
Fetish	Something that is believed to have magical powers	Proclivity, Talisman	Dislike, Fairness
Fiasco	A ludicrous and complete failure	Breakdown, Debacle	Miracle, Success
Fictitious	Unreal	Fabricated	Authentic
Flaccid	Lacking firmness	Flabby, Limp	Firm, Taut
Flagrant	Outstandingly bad	Glaring, Scandalous	Concealed, Good
Flamboyant	Elaborately showy	Florid, Ornate	Dull, Plain
Flaunt	Display or wave boastfully	Advertise, Brandish	Hide, Conceal
Fleeting	Passing swiftly	Transitory, Fugitive	Enduring, Lastly
Fluctuate	To waver from one course to another	Oscillate, Vacillate	Remain, Stay
Forbear	To exercise self-control	Restrain, Abstain	Accept, Aid
Forensic	Pertaining to public discussion	Rhetorical, Oratorical	-
Fortuitous	Accidental	Casual, Incidental	Calculated, Deliberate
Fracas	A disorderly quarrel	Brawl, Altercation	Agreement, Calm
Frustrate	To defeat or render ineffectual	Balk, Thwart	Abet
Fulsome	Disgustingly excessive	Adulatory, Glib	Reasonable, Sincere
Garnish	To trim or decorate	Adorn, Deck	Decrease, Plainness
Genealogy	A record of a person's or a family's ancestors	Lineage	-
Genesis	Origin	Inception	Completion
Gesticulate	To make gestures	Gesture, Motion	-
Ghastly	Horrible, Deathlike	Gruesome, Grisly	Beautiful, Great
Gibe	To laugh at	Mock, Sneer	Complement, Praise
Glib	Smooth-spoken	Artful, Articulate	Quiet, Silent
Gluttonous	Inclined to cat to excess	Voracious, Intemperate	-
Gossamer	A very thin gauzelike fabric	Diaphanous, Flimsy	Ponderous
Gregarious	Habitually fond of associating in a company or herd	Affable, Sociable	Unfriendly
Grimace	A distortion of the face to express an attitude or feeling	Frown, Scowl	Grin

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Word	Meaning	Synonym	Antonym
Hail	To greet	Accost, Salute	-
Harangue	To deliver a long noisy speech	Rant, Declaim	-
Harbinger	A forerunner	Precursor, Herald	-
Haughty	Proud	Cavalier, Snooty	Humble, Shy
Heedless	Thoughtless	Inadvertent, Rash	Prudent, Circumspect
Heinous	Wicked	Atrocious	Delightful, Friendly
Heresy	An opinion held in opposition to the traditional view	Heterodoxy	Orthodoxy
Hiatus	A gap or vacancy	Breach	Closure, Closing
Histrionic	Pertaining to the theatre	Dramatic, Theatrical	-
Hoax	A trick or deception	Canard	Be honest
Homonym	Two words having the same sound but different meanings	Homophone	-
Hovel	A dirty or wretched dwelling	Cottage, Hut	-
Hyperbole	Extravagant exaggeration for effect	Overstatement	Understatement
Hypothesis	An assumption made for the sake of argument	Supposition	Fact, Proof
Idiosyncrasy	A. personal peculiarity	Eccentricity, Foible	Usualness
Ignominious	Incurring public disgrace	Infamous, Degrading	Renowned
Immaculate	Spotless	Undefiled, Unsullied	Defiled, Sullied
Imminent	Likely to occur soon	Impending	Avoidable
Immune	Exempt from	Unsusceptible	Hindered
Impale	To pierce through with a pointed instrument	Prick, Transfix	Close
Impeach	To accuse (a public official) of wrongdoing	Arraign	Absolve
Impeccable	Faultless	Consummate	Culpable, Fallible
Impervious	Incapable of being penetrated	Impermeable	Permeable
Implacable	Incapable of being soothed	Unrelenting, Inexorable	Forbearing
Implicit	Implied but not clearly expressed	Tacit, Implied	Explicit
Import	significance or importance	Purport, Moment	Exterior, Outside
Impostor	A person who practices deception under an assumed character	Actor, Hypocrite	-
Imprecation	A curse or malediction	Swearing	Benediction
Impregnable	Unconquerable	Invincible	Vulnerable
Impropriety	Improper act	Indecency, Indecorum	Amenity
Improvident	Lacking in thrift	Prodigal, Shiftless	Careful, Miserly
Impugn	To attack or criticize as false	Assail, Contravene	Agree, Aid
Incarcerate	To imprison	Intern, Immure	Emancipate
Incisive	Cutting, Penetrating	Sarcastic, Mordant	Weak, Gentile
Incognito	With one's identity concealed	Anonymous	Known
Incontrovertible	Indisputable	Irrefutable, Indubitable	Changeable
Increment	An increase	Accrual	Decline
Incumbent	An officeholder	Mandatory, Imperative	Unnecessary
Indefatigable	Untiring	Unflagging	Changing, Ideal
Indigenous	Native	Innate, Inborn	Alien
Inference	A conclusion reached by reasoning from data or premises	Deduction, Implication	Fact, Proof

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Word	Meaning	Synonym	Antonym
Ingenious	Demonstrating originality	Inventive, Adroit	Maladroit, Gauche
Ingenuous	Simple and straightforward	Unsophisticated	Sophisticated
Inhibit	To check or hinder	Restrain, Curb	Promote
Innocuous	Harmless, Inoffensive	Banal, Bland	Delicious, Tasty
Innuendo	An indirect reference or suggestion	Intimate, Insinuate	Evidence, Proof
Inordinate	Excessive	Immoderate	Cheap, Logical
Insatiable	Unable to be satisfied	Unappeasable	Fulfilled
Inscrutable	Incapable of interpretation or understanding	Unfathomable, Cryptic	Clear, Intelligible
Insidious	Working secretly or slyly	Wily, Crafty	Fair, Honest
Instigate	To stir tip	Foment, Incite	Deter, Discourage
Integrity	Honesty, Moral soundness	Probity, Uprightness	Deceit, Dishonesty
Inveigh	To speak angrily	Rail, Denounce	Accept, Agree
Irascible	Easily angered	Choleric, Petulant	Placid, Equable
Ire	Anger	Resentment	Calm, Calmness
Irksome	Tedious	Irritating	Helpful
Itinerant	Traveling about	Nomadic	Settled
Jargon	Confused	Gibberish, Argot	Standard, Quiet
Jaunty	Having an air of easy carelessness or liveliness	Sprightly, Airy	Staid
Jeopardy	Danger	Hazard, Peril	Assurance
Jettison	To throw overboard	Abandon, Scrap	Assert, Defend
Judicious	Wise	Discreet, Politic	Careless, Ignorant
Kaleidoscopic	Constantly changing or varying in pattern or scenes	Motley	Monochrome
Ken	Range of sight or understanding	Insight	Blindness
Lachrymose	Causing or given to shedding tears	Sad, Tearful	-
Laconic	Saying much in few words	Concise, Pithy	Verbose, Prolix
Larceny	Theft	Burglary	Lot
Latent	Hidden	Dormant, Quiescent	Apparent, Patent
Lavish	Profuse or generous	Superabundant	Niggardly, Frugal
Lethal	Deadly	Mortal, Fatal	Harmless, Healthy
Longevity	Prolonged duration of life	Durability	-
Lucid	Clear; Transparent	Pellucid, Perspicuous	Cloudy, Dark
Ludicrous	Ridiculous	Mirthful, Droll	Lugubrious
Luminary	An eminent person	Celebrity	Nobody
Machiavellian	Sacrificing moral principles in order to attain power	Unscrupulous	-
Malicious	Bearing or acting with	Rancorous	Benign
Masquerade	To assume a deceptive appearance or character	Dissemble, Feign	Honesty, Reality
Maudlin	Sentimental to the point of tears	Lachrymose	Unemotional
Meander	To walk about (or talk) aimlessly	Ramble	Stay, Untwist
Mediocre	Average in quality	Descent, Dull	Different, Excellent
Mercenary	Acting solely from a consideration of reward or profit	Venal	Generous, Unselfish
Meretricious	Attracting in a false	Tawdry, Specious	Genuine, Real
Meticulous	Fussy about minute details	Punctilious	Perfunctory
Mettle	Disposition, Spirit	Spunk, Stamina	Cowardice
Microcosm	A little world	Earth, Nature	-
Mimic	To make fun of or copy by imitating	Mime, Actor	Fan

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Word	Meaning	Synonym	Antonym
Misanthropic	Hating or distrusting mankind	Antisocial, Egoistic	Humanitarian
Monologue	A speech by one person	Soliloquy	Colloquy
Morose	Gloomy, ill-humoured	Sulky, Crabbed	Blithe, Genial
Motley	Of various colours	Piebald, Variegated	Homogeneous
Mottled	Spotted or streaked with varied colours	Blotched, Dappled	Plain
Mundane	Of, or pertaining to	Earthly, Terrestrial	Abnormal, Uncommon
Murky	Dark	Dismal, Tenebrous	Resplendent, Glowing
Mutable	Given to frequent change in nature	Vacillating, Fickle	Constant, Steady
Myriad	Innumerable	Countless, Endless	Bounded
Nautical	Pertaining to ships or navigation	Marine, Naval	-
Nettle	To irritate or provoke	Vex, Pique	Aid, Appease
Nocturnal	Pertaining to, or occurring in, the night	Nightly, After dark	Diurnal
Noisome	Foul-smelling	Malodorous, Fetid	Salubrious
Nonchalant	Unmoved or indifferent	Apathetic	Enthusiastic, Zealous
Nostalgia	Homesickness	Longing, Remorse	-
Notorious	Widely known (in a bad sense)	Blatant, Flagrant	Inconspicuous
Novice	A beginner	Tyro, Neophyte	Virtuoso
Obdurate	Hard-hearted	Adamant, Unyielding	Submissive, Docile
Oblivious	Forgetful	Unmindful, Heedless	Attentive, Aware
Obsession	A persistent feeling	Mania, Infatuation	Indifference, Dislike
Obsolete	No longer in use	Archaic, Antiquated	Current, Modern
Obtrusive	Thrusting oneself or itself into undue prominence	Intrusive, Aggressive	Modest, Shy
Obviate	To prevent by appropriate actions	Preclude, Forestall	Support, Aid
Omnipotent	All-powerful	Almighty, Divine	Impotent, Weak
Onus	Burden	Blame, Blot	Advantage, Benefit
Ostensible	Apparent	Professed, Plausible	Improbable, Obscure
Ostracize	To banish	Outlaw	Accept, Admit
Panacea	A remedy for all ills	Nostrum	Disease, Injury
Panegyric	A speech or writing of extravagant praise	Eulogy, Adulation	Censure, Disparagement
Paradox	A self -contradictory statement	Anomaly	Normality, Regularity
Paraphrase	To restate the meaning of a passage in other words	Digest, Explanation	Quotation
Parody	A humorous imitation of an author's style and mannerisms	Burlesque	Flattery
Peccadillo	A very minor or slight sin	Frailty, Foible	-
Pecuniary	Pertaining to money	Financial, Fiscal	-
Pedant	One who proudly shows off his learning or who overrates his knowledge	Bluestocking	-
Pensive	Sadly thoughtful	Reflective, Meditative	Negligent, Uncaring
Peremptory	Positive in expressing an opinion	Decisive, Resolute	Indecisive, Tentative
Pertinacious	Clinging doggedly to an opinion or purpose	Obdurate, Tenacious	Irresolute, Tentative
Peruse	To read carefully	Analyse, Browse	Neglect, Overlook
Perverse	Willfully bent on doing the wrong thing	Headstrong, Refractory	Agreeable

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Word	Meaning	Synonym	Antonym
Petrify	To paralyze with horror	Stupefy, Stun	Liquefy, Soften
Plagiarism	Adopting and reproducing	Falsification	Return, Original
Platitude	A dull and commonplace remark	Bromide, Truism	Coinage, Nuance
Plebeian	Pertaining to the common people	Pedestrian	Patrician
Plebiscite	A direct vote by the people	Election, Poll	-
Poignant	Gripping and moving the feelings powerfully	Bitter, Disturbing	Cheerful, Happy
Ponderous	Very heavy	Awkward, Bulky	Adroit, Clever
Precarious	Uncertain or risky	Dangerous	Certain, Definite
Precipitous	Very steep	Abrupt, Craggy	Calm, Flat
Prelude	A preliminary step	Preface, Prologue	Epilogue
Prerogative	A privilege or power attaching to a position	Immunity, Perquisite	Duty, Obligation
Prestige	Esteem accorded for recognized achievements or reputation	Cachet, Dignity	Disregard, Disrespect
Presumption	Something taken for granted	Effrontery	Fact, Knowledge
Prevaricate	To disguise or conceal the truth to lie	Quibble	Veracity, Verity
Procrastinate	To postpone or put off to another time	Defer, Delay	Abbreviate
Prognosticate	To forecast	Presage, Portend	-
Proletariat	The wage-earning class	Lower class	-
Promontory	A cliff	Headland	-
Promulgate	To publish or proclaim	Disseminate	Collect, Conceal
Protuberant	Bulging or swelling out	Arched, Bent	Receding
Provisional	Temporary	Tentative	Certain, Definite
Proximity	Nearness-worked in close proximity to his home	Propinquity, Vicinity	Remoteness
Pseudonym	A false name assumed by a writer	Alias, Pen name	-
Punitive	Inflicting, or concerned with, punishment	Disciplinary, Penal	Beneficial
Quash	To crush	Suppress	Compliment
Querulous	Given to fault-finding and complaining	Fretful, Whining	Affable
Quixotic	Extravagantly romantic or idealistic	Utopian, Visionary	Cautious, Practical
Raconteur	A skilled storyteller	Narrator	-
Radical	One who advocates extreme basic changes	Profound, Basal	Inessential, Minor
Ramification	A branching	Complication	Cause, Origin
Raze	To tear down completely	Level	Rear
Recapitulate	To restate in a brief	Recap, Rehash	Take back
Reciprocal	Done in return for something received	Mutual	Dissimilar
Recumbent	Lying down	Decumbent	-
Redolent	Aromatic	Evocative	-
Redoubtable	Commanding fear or respect	Formidable	-
Refute	To prove incorrect or false	Rebut, Confute	Substantiate
Reiterate	Repeat (several times)	Echo, Renew	Take back
Remunerative	Profitable	Lucrative, Gainful	-
Renegade	One who forsakes party principles	Turncoat, Apostate	Obedient
Reprisal	Injury inflicted in turn for one received	Retaliation	Forgiveness
Resentment	Feeling of displeasure from mistreatment	Umbrage, Dudgeon	Cheer, Comfort
Resilient	Elastic	Flexible, Pliable	Delicate, Weak
Respite	Temporary deferment or cessation of work or pain	Surcease	Advance, Blame

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Word	Meaning	Synonym	Antonym
Retribution	The reward or punishment exacted for an injury or other action	Requital, Nemesis	Forgiveness
Retrieve	To make good -retrieved a mistake	Fetch, Recapture	Break, Damage
Reverberate	To echo	Resound	Quieten
Rudimentary	In an early stage of development	Incipient	Complex
Rue	To be sorry for	Regret, Repent	Praise, Delight
Sacrosanct	Very holy	Consecrated	-
Sagacious	Wise, shrewd	Perspicacious	Careless
Sallow	Sick	Pallid	Rubicund
Sally	To rush forth suddenly	Quip, Banter	-
Sanctimonious	Pretending to be religious	Hypocritical	Forthright
Sanguinary	Bloody	Gory	-
Sanguine	Of a hopeful disposition	Buoyant, Ardent	Depressed
Sartorial	Pertaining to a tailor or clothes	Flashy, Elegant	Dumpy, Frumpy
Satellite	An attentive or flattering follower	Lackey, Toady	-
Scintilla	A trace	Iota, Vestige	Dullness, Glob
Scourge	To punish severely	Curse, Pest	Reward, Benefit
Scrutinize	To examine carefully	Analyse, Check	Forget, Ignore
Shibboleth	A party slogan	Catchword, Custom	-
Simper	To smile in a silly or affected way	Smirk	-
Sinecure	Employment entailing little or no responsibility	Pushover	-
Sinister	Threatening or showing evil	Dire, Evil	Auspicious
Sleazy	Flimsy and cheap	Unsubstantial	Seedy, Fine
Slovenly	Untidy	Slipshod, Slatternly	Clean, Ordered
Soporific	Tending to induce sleep	Calming, Hypnotic	Awake
Sordid	Mean and base	Degraded, Vile	Clean, Decent
Sovereign	Supreme power and authority	Autonomous	Dependent
Sporadic	Occurring singly	Desultory, Fitful	Common
Spurn	To refuse or reject with contempt	Repel, Snub	Accept, Admire
Stoic	Indifferent, calm in bearing pain or pleasure	Stolid, Impassive	Caring, Concerned
Stringent	Strict	Exacting, Rigid	Amenable, Calm
Stupendous	Amazing by	Astounding	Terrible
Succulent	Juicy	Luscious, Yummy	Un-juicy, Dry
Supine	Lying flat on the back	Horizontal, Level	-
Tangible	Real	Material, Veritable	Abstract, Unreal
Tantamount	Equivalent	Identical, Alike	Different, Polar
Taunt	To reproach with contempt	Mock, Twit	Flattery
Teeming	In abundance	Swarming, Fruitful	Empty, Lacking
Temerity	Unwise or reckless boldness	Audacity	Prudence
Temporal	Worldly	Mundane, Secular	Mental, Spiritual
Temporize	To delay or refuse to commit oneself in order to gain time	Equivocate	Advance, Face
Tenet	A principle of belief held as true	Creed, Doctrine	Assumption
Tenuous	Slender, not substantial	Delicate, Sketchy	Certain, Definite
Tranquil	Calm, peaceful	Balmy, Calm	Drunk, Fierce
Transgress	To break a law or command	Infringe, Trespass	Behave, Obey
Tremulous	Trembling	Quivering	Brave, Calm
Trivial	Of little	Paltry	Gross
Truculent	Cruel, Fierce	Brutal, Caustic	Gentle, Mild

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Word	Meaning	Synonym	Antonym
Turgid	Swollen, Inflated	Bloated, Distended	Humble
Ubiquitous	Existing everywhere	Omnipresent	Rare, Scarce
Untenable	Incapable of being defended or held	Illogical, Unsound	-
Utilitarian	Materially or practically useful	Functional	Impractical
Vanquish	To subdue or conquer	Conquer, Crush	Release, Win
Vaunt	To boast	Brag, Proclaim	Conceal, Hide
Veneer	A superficial appearance designed to impress one with superiority	Gloss	Reality
Venerable	Deserving respect or reverence because of age	Esteemed, Grand	Common
Vernal	Pertaining to spring-an array of vernal flowers	Fresh, Spring	Autumnal
Versatile	Able to do many things skilfully	Gifted, Skilled	Dull, Inept
Vicarious	Taking the place of another	Deputed, Eventual	-
Virago	A scolding or ill-tempered woman	Shrew, Termagant	-
Vituperate	To scold or blame loudly	Berate, Revile	Absolve
Waive	To give up	Relinquish, Forgo	Expedite
Whim	A sudden notion or passing fancy	Caprice, Vagary	Actuality
Writhe	To twist about (usually with pain)	Contort, Squirm	Straighten
Zealous	Full of enthusiasm or eagerness	Ardent, Avid	Perfunctory
Zenith	The highest point	Acme, Apex	Nadir

Now, let us consider some examples regarding Synonym of a word. In all the following questions choose one from the given four options which the closest similar in meaning of the given word.

Example [GA-2010 (1 mark)]: Circuitous
(a) cyclic (b) indirect (c) confusing (d) crooked
Solution (a): Circuitous means 'round about or not direct'. Not direct does not mean indirect; so we choose option (a), i.e., cyclic which is closest to round about.

Example [GA-2010 (1 mark)]: Exhorts
(a) urge (b) condemn (c) restrain (d) scold
Solution (a): Exhort means 'to strongly encourage or try to persuade someone to do something'; so from the given options, the closest meaning of exhort is urge, which means 'a strong desire'

Example [GA-2010 (1 mark)]: Ephemeral
(a) effeminate (b) ghostlike (c) soft (d) short-lived
Solution (d): Ephemeral means 'lasting for only a short time'; so we choose option (d).

Example [GA-2011 (1 mark)]: Inexplicable
(a) Incomprehensible (b) Indelible (c) Inextricable (d) Infallible
Solution (a): Inexplicable means 'unable to be explained or understood'; so we choose option (a), i.e., Incomprehensible, which means 'impossible or extremely difficult to understand'.

Example [GA-2012 (1 mark)]: Pacify
(a) Excite (b) Soothe (c) Deplete (d) Tire
Solution: Pacify means 'to cause someone who is angry or upset to be calm and satisfied'; so we choose option (b), i.e., Soothe, which means 'to make someone feel calm or less worried'.

Example [GA-2012 (1 mark)]: Mitigate
(a) Diminish (b) Divulge (c) Dedicate (d) Denote
Solution (a): Mitigate means 'to make something less harmful, unpleasant or bad'; so we choose option (a), i.e., Diminish, which means 'to reduce or to be reduced in size or importance'.

Example [GA-2012 (1 mark)]: Latitude

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(a) Eligibility (b) Freedom (c) Coercion (d) Meticulousness
Solution (b): Latitude means 'a place or region as marked by the distance'; so we choose option (b), i.e., Freedom which means 'unbounded'.

Example [GA-2013 (1 mark)]: Primeval
(a) Modern (b) Historic (c) Primitive (d) Antique
Solution (c): Primeval means 'existing at or from a very early time'; so we choose option (c), i.e., Primitive, which means 'relating to human society at a very early stage of development'.

Example [GA-2013 (1 mark)]: Nadir
(a) Highest (b) Lowest (c) Medium (d) Integration
Solution (b): Nadir means 'the worst moment or the moment of least hope and least achievement'; so we choose option (b).

Example [GA-2015 (1 mark)]: Educe
(a) Exert (b) Educate (c) Extract (d) Extend
Solution (c): Educe means 'to draw forth or bring out'; so we choose option (c), i.e., Extract, which means 'to remove or taken out something'.

Example [GA-2015 (1 mark)]: Awkward
(a) Inept (b) Graceful (c) Suitable (d) Dreadful
Solution (a): Awkward means 'lacking skill or dexterity'; so we choose option (a), i.e., Inept, which means 'Not skilled or effective'.

Example [GA-2015 (1 mark)]: Dreary
(a) Cheerful (b) Dreamy (c) hard (d) dismal
Solution: Dreary means 'boring and making you feel unhappy'; so we choose option (d), i.e., dismal, which means 'sad and without hope'.

Example [GA-2015 (1 mark)]: Which word is <u>not</u> a synonym for the word *vernacular*?
(a) Regional (b) Indigenous (c) Indigent (d) Colloquial
Solution (c): Vernacular means 'the form of a language that a regional or other group of speakers use naturally, especially in informal situations'. Indigenous means 'naturally existing in a place or country rather than arriving from another place'. Indigent means 'very poor'. Colloquial means 'informal and more suitable for use in speech than in writing'. Thus Indigent is nor a synonym for Vernacular.

In the following questions choose the option which is the closest in meaning to the phrase underlined in the sentence below?

Example [GA-2014 (1 mark)]: A student is required to demonstrate a high level of <u>comprehension</u> of the subject, especially in the social sciences.
(a) understanding (b) meaning (c) concentration (d) stability
Solution (a): Comprehension means 'the ability to understand completely and be aware of a situation, facts, etc.'; understanding means 'to know the meaning of something that someone says'; meaning means 'to express or represent something such as an idea, thought, or fact'; concentration means 'the ability to think carefully about something you are doing and nothing else'; stability means 'when something is not likely to move or change'.

Example [GA-2014 (1 mark)]: In a democracy, everybody has the freedom to <u>disagree</u> with the government.
(a) Dissent (b) Descent (c) decent (d) decadent
Solution (a): Disagree means 'to not agree'; Dissent means 'to disagree with other people about something'; Descent means 'a movement down'; Decent means 'socially acceptable or good'; Decadent means 'having low moral standards and behaviour'.

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Example [GA-2014 (1 mark)]: While receiving the award, the scientist said, "I feel vindicated".
(a) Punished (b) Substantiated (c) appreciated (d) chastened
Solution (b): Vindicate means 'to prove that someone is free from guilt or blame, after other people blamed them'; Punish means 'to cause someone who has done something wrong by hurting them, forcing them to pay money, etc.'; Substantiated means 'to show something to be true, or to support a claim with facts'; Appreciate means 'to recognize or understand that something is valuable, important or as described'; Chasten means 'to make someone aware that they have failed or done something wrong and make them want to improve'.

Example [GA-2015 (1 mark)]: Which of the following options is the closest in meaning to the sentence below? *She enjoyed herself immensely at the party.*
(a) She had a terrible time at the party (b) She had a horrible time at the party
(c) She had a terrific time at the party (d) She had a terrifying time at the party
Solution (c): Immensely means 'extremely'; terrible means 'very unpleasant or serious or of low quality'; horrible means 'very unpleasant or bad'; terrific means 'very good'; terrifying means 'o frighten someone very much'.

Example [GA-2014 (1 mark)]: Match the columns.

Column 1	Column 2
1. Eradicate	A. Misrepresent
2. distort	B. soak completely
3. saturate	C. use
4. utilize	D. destroy utterly

(a) 1:D, 2:A, 3:B, 4:C (b) 1:A, 2:B, 3:C, 4:D
(c) 1:B, 2:C, 3:D, 4:A (d) 1:D, 2:A, 3:C, 4:B
Solution (a): Eradicate means 'to get rid of completely or destroy something bad'; so 'Eradicated' matches to 'destroy utterly'. Distort means 'to change something from its usual or origin'; so 'Distort' matched to 'misrepresent'. Saturate means 'to make something or someone completely wet'; so 'Saturate' matches to 'soak completely'. Utilize means 'to use something in an effective way'; so 'Utilize' matches to 'use'. Thus we have synonym pairs 1:D, 2:A, 3:B, 4:C, which is option (a).

Example [GA-2015 (1 mark)]: Which one of the following combinations is incorrect?
(a) Acquiescence – Submission
(b) Wheedle – Roundabout
(c) Flippancy – Lightness
(d) Profligate – Extravagant
Solution (b): Acquiesce means 'to accept or agree to something, often unwillingly'; Submission means 'when a person or group submits to someone'. Wheedle means 'to persuade or try to persuade by coaxing words'; Roundabout means 'circuitous'. Flippancy means 'lack of respect or seriousness'; Lightness means 'the state of being light'. Profligate means 'wasteful with money'; Extravagant means 'using or doing more than necessary in an uncontrolled way'. Thus the pair given in option (b) is not correct pair; as all other pairs are synonym pairs.

Example [GA – 2016 (1 mark)]: The Buddha said, "Holding on to anger is like grasping a hot coal with the intent of throwing it at someone else; you are the one who gets burnt."
Select the word below which is closest in meaning to the word underlined above.
(a) burning (b) igniting (c) clutching (d) flinging
Solution (c): 'Grasping' means 'to quickly take something in your hand and hold it firmly'.
'Burning' means 'to be on fire' or to produce flames'.
'Igniting' means 'to start burning or explode'.
'Clutching' means 'to take or try to take hold of something tightly, usually in fear, anxiety or pain'.
'Flinging' means 'to throw something or someone suddenly and with a lot of force'.
So option (c) is correct and 'clutching' is closest in meaning with 'grasping'.

Exercise 2.1

For 1 to 30: Choose one from the given four options which the closest similar in meaning of the given word. For 31 to 45: Choose one from the given four options which the closest similar in meaning of the underlined word in the given sentence. For 46 to 55: Match the words in column

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I with their closest similar in meaning in Column II. For 56 to 60: Choose the correct synonym pair. For 61 to 65: Choose the incorrect synonym pair.

1. Saccharine	(a) Leave	(b) Sweet	(c) Arid	(d) Quit
2. Jovial	(a) Incredulous	(b) Merry	(c) Revolting	(d) Dizzy
3. Qualm	(a) Distress	(b) Impunity	(c) Preserve	(d) Scruple
4. Reverie	(a) Palimpsest	(b) Phantom	(c) Daydream	(d) Curio
5. Loquacious	(a) Talkative	(b) Thirsty	(c) Beautiful	(d) Complicated
6. Inscrutable	(a) Difficult	(b) Mysterious	(c) Inflexible	(d) Wary
7. Nabob	(a) Bigwig	(b) Doubter	(c) Frolic	(d) Converse
8. Stentorian	(a) Violent	(b) Misbegotten	(c) Loud	(d) Stealthy
9. Deplete	(a) Decorate	(b) Beg	(c) Exhaust	(d) Hurry
10. Miserable	(a) Cruel	(b) Wrong	(c) Unhappy	(d) Miss
11. Refute	(a) Garbage	(b) Deny	(c) Offer	(d) Difficult
12. Vintage	(a) Classic	(b) Alcoholic	(c) Disease	(d) Spoiled
13. Zest	(a) Gusto	(b) Cram	(c) Worry	(d) Trial
14. Haggle	(a) Tired	(b) Climb	(c) Decrease	(d) Bargain
15. Throng	(a) Garment	(b) Bell	(c) Mass	(d) Weight
16. Irksome	(a) Outrageous	(b) Fearsome	(c) Impoverished	(d) Annoying
17. Misprize	(a) Despise	(b) Devalue	(c) Erroneous	(d) Covet
18. Protract	(a) Hire	(b) Fold	(c) Delay	(d) Corner
19. Impugn	(a) Imply	(b) Fret	(c) Assail	(d) Recalcitrant
20. Exigent	(a) Urgent	(b) Treatise	(c) Miser	(d) Expedient
21. Fervid	(a) Delightful	(b) Difficult	(c) Obstinate	(d) Ardent
22. Ersatz	(a) Chaotic	(b) Artificial	(c) Impromptu	(d) Vague
23. Propinquity	(a) Habit	(b) Nearness	(c) Capacity	(d) Tendency
24. Redolent	(a) Ubiquitous	(b) Odorous	(c) Shy	(d) Bellicose
25. Vociferous	(a) Numerous	(b) Bountiful	(c) Strident	(d) Garrulous
26. Turpitude	(a) Lethargy	(b) Honour	(c) Belligerence	(d) Depravity
27. Infirm	(a) Hospital	(b) Weak	(c) Short	(d) Fortitude
28. Lull	(a) Pause	(b) Noise	(c) Boring	(d) Mark
29. Mutiny	(a) Rebellion	(b) Currency	(c) Sailor	(d) Hassle
30. Malign	(a) Evil	(b) Malicious	(c) Slander	(d) Grandiose

31. This new magazine is known for its <u>comprehensive</u> coverage of news
(a) all-inclusive (b) circumscribed (c) partial (d) demarcate

32. Many people suffer setbacks in their career because of their inherent <u>levity</u>.
(a) Gravity (b) frivolity (c) gloom depression

33. There was something strange and <u>morbid</u> about the whole house.
(a) Jocund (b) enraptured (c) ghastly (d) joyful

34. His critics found in his <u>overt</u> statements some hidden designs.
(a) apparent (b) patent (c) undisguised (d) manifest

35. Given these constraints, we had no alternative but to suggest an <u>improvised</u> solution.
(a) planned (b) outlined (c) prospective (d) makeshift

36. The proposal was <u>denounced</u> by one and all.
(a) excoriate (b) exonerate (c) exculpate (d) exalt

37. With ignorance is sometimes bliss, <u>illiteracy</u> is always considered a curse.
(a) cognition (b) grasp (c) perception (d) oblivion

38. She is a woman of <u>sterling</u> qualities.
(a) interesting (b) genuine (c) irritating (d) exciting

39. People thronged to pay <u>homage</u> to the departed leader.
(a) humility (b) tribute (c) obedience (d) allegiance

40. For better health we must <u>refrain</u> from smoking.

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(a) dissuade (b) desist (c) prevent (d) curb

41. Valiant Vicky used to <u>boast</u> of his bravery to his beloved wife.
(a) cry (b) abuse (c) hate (d) brag

42. The article was so well written that it <u>merited</u> careful study.
(a) deserved (b) encouraged (c) prompted (d) supported

43. Although the boys in his class were naughty, he never restored to <u>corporal</u> punishment.
(a) harsh (b) physical (c) unjust (d) general

44. The <u>surreptitious</u> movements of a lone figure among the dunes filled with villagers with curiosity and awe.
(a) invisible (b) nocturnal (c) secret (d) concealed

45. His brother is leading a <u>sequestered</u> life.
(a) secluded (b) unhealthy (c) disreputable (d) affluence

46. Match the columns

Column I	Column II
A. Charm	1. Extraordinary
B. Preternatural	2. Retaliation
C. Reprisal	3. Seditious
D. Factious	4. Appeal

(a) A – 4, B – 1, C – 2, D – 3
(b) A – 1, B – 2, C – 3, D – 4
(c) A – 2, B – 4, C – 3, D – 1
(d) A – 3, B – 1, C – 2, D – 4

47. Match the columns

Column I	Column II
A. Pretty	1. Beautiful
B. Manifold	2. Extreme
C. Grapple	3. Diverse
D. Dire	4. Struggle

(a) A – 4, B – 2, C – 1, D – 3
(b) A – 3, B – 1, C – 4, D – 2
(c) A – 1, B – 3, C – 4, D – 2
(d) A – 1, B – 3, C – 2, D – 4

48. Match the columns

Column I	Column II
A. Sundry	1. Jubilant
B. Venerate	2. Replace
C. Exultant	3. Various
D. Supplant	4. Esteem

(a) A – 4, B – 2, C – 3, D – 1
(b) A – 3, B – 4, C – 1, D – 2
(c) A – 1, B – 2, C – 3, D – 4
(d) A – 2, B – 3, C – 4, D – 1

49. Match the columns

Column I	Column II
A. Spite	1. Sprinkle
B. Pretension	2. Commonplace
C. Mundane	3. Malice
D. Drizzle	4. Ambition

(a) A – 1, B – 2, C – 3, D – 4
(b) A – 4, B – 3, C – 1, D – 2
(c) A – 2, B – 1, C – 4, D – 3

51. Match the columns

Column I	Column II
A. Hinder	1. Dormant
B. Diffuse	2. Check
C. Latent	3. Scatter
D. Wretched	4. Unpleasant

(a) A – 2, B – 3, C – 1, D – 4
(b) A – 1, B – 3, C – 2, D – 4
(c) A – 3, B – 1, C – 4, D – 2
(d) A – 4, B – 2, C – 3, D – 1

52. Match the columns

Column I	Column II
A. Regulate	1. Justify
B. Warrant	2. Austerity
C. Rigor	3. Police
D. Discrete	4. Distinct

(a) A – 1, B – 2, C – 3, D – 4
(b) A – 3, B – 2, C – 4, D – 1
(c) A – 3, B – 1, C – 2, D – 4
(d) A – 2, B – 4, C – 3, D – 1

53. Match the columns

Column I	Column II
A. Remote	1. Hate
B. Detest	2. Pleasant
C. Gracious	3. Relatives
D. Kin	4. Distant

(a) A – 2, B – 1, C – 4, D – 3
(b) A – 4, B – 1, C – 2, D – 3
(c) A – 3, B – 4, C – 1, D – 2
(d) A – 1, B – 3, C – 2, D – 4

54. Match the columns

Column I	Column II
A. Banish	1. Pull
B. Fraud	2. Exile
C. Drag	3. Neutral
D. Indifferent	4. Imposter

(a) A – 3, B – 2, C – 1, D – 4
(b) A – 4, B – 2, C – 3, D – 1
(c) A – 1, B – 3, C – 4, D – 2

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(d) A – 3, B – 4, C – 2, D – 1

50. Match the columns

Column I	Column II
A. Voluntary	1. Intersection
B. Tart	2. Willing
C. Imperial	3. Regal
D. Corner	4. Acid

(a) A – 4, B – 1, C – 3, D – 2
(b) A – 3, B – 4, C – 2, D – 1
(c) A – 1, B – 4, C – 3, D – 2
(d) A – 2, B – 4, C – 3, D – 1

55. Match the columns

Column I	Column II
A. Charisma	1. Cautious
B. Generic	2. Charm
C. Wary	3. Luxurious
D. Sumptuous	4. General

(a) A – 1, B – 4, C – 2, D – 3
(b) A – 2, B – 1, C – 4, D – 3
(c) A – 2, B – 4, C – 1, D – 3
(d) A – 4, B – 3, C – 2, D – 1

56. Which one of the following combinations is correct?
(a) Loot : Waste
(b) Chimera : Protest
(c) Temerity : Audacity
(d) Educe : Ideal

61. Which one of the following combinations is incorrect?
(a) Decorum : Etiquette
(b) Jejune : Insipid
(c) Tumid : Aggressive
(d) Querulous : Fretful

57. Which one of the following combinations is correct?
(a) Distort : Harm
(b) Reel : Whirl
(c) Upright : Horizontal
(d) Pall : Carry

62. Which one of the following combinations is incorrect?
(a) Wrath : Crime
(b) Calamity : Disaster
(c) Pompous : Arrogant
(d) Prevalent : Widespread

58. Which one of the following combinations is correct?
(a) Cheat : Argue
(b) Impel : Force
(c) Lax : Strive
(d) Supervene : Displace

63. Which one of the following combinations is incorrect?
(a) Superficial : Shallow
(b) Tangle : Snarl
(c) Reform : Display
(d) Methodical : Systematic

59. Which one of the following combinations is correct?
(a) Delirious : Calm
(b) Lure : Tickle
(c) Isolation : Fear
(d) Outfit : Costume

64. Which one of the following combinations is incorrect?
(a) Scale : Climb
(b) Smudge : Blurry
(c) Affect : Cultivate
(d) Prerequisite : Necessary

60. Which one of the following combinations is correct?
(a) Naïve : Secular
(b) Solemnity : Sleepiness
(c) Omit : Prohibit
(d) Pitched : Retracted

65. Which one of the following combinations is incorrect?
(a) Glare : Scowl
(b) Erratic : Irregular
(c) Civil : Public
(d) Peer : Recluse

Now, let us consider some examples regarding Antonym of a word. In all the following questions choose one from the given four options which the closest opposite in meaning of the given word.

Example [GA-2011 (1 mark)]: Deference
(a) Aversion (b) Resignation (c) Suspicion (d) Contempt
Solution (d): Deference means 'respect and politeness'; so we choose option (d), i.e., Contempt, which means 'a strong feeling of combined dislike and lack of respect'.

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Example [GA-2011 (1 mark)]: Frequency
(a) Periodicity (b) Rarity (c) Gradualness (d) Persistency
Solution (b): Frequency means 'the number of times something happens within a particular period'. So we choose option (b), i.e., Rarity, which means 'something that is very unusual'.

Example [GA-2011 (1 mark)]: Amalgamate
(a) Merge (b) Split (c) Collect (d) Separate
Solution (b): Amalgamate means 'to join to form a larger organisation or group, or to make separate organisations do this'. So we choose option (b), i.e., Split, which means 'divide into two or more parts, especially along a particular line'.

Example [GA-2011 (1 mark)]: Polemical
(a) Imitative (b) Conciliatory (c) Truthful (d) Ideological
Solution (b): Polemical means 'of or involving strongly critical or disputatious writing or speech'. So we choose option (b), i.e., Conciliatory, which means 'making peace or attempting to resolve a dispute through goodwill'.

Example [GA-2014 (1 mark)]: Coherent
(a) Sticky (b) Well-connected (c) Rambling (d) Friendly
Solution (c): Coherent means 'logical and consistent argument, theory, etc.'; so we choose option (c), i.e., Rambling, which means 'lengthy and confused or inconsequential writing or speech, etc.'

Exercise 2.2

For 1 to 45: Choose one from the given four options which the closest opposite in meaning of the given word. For 46 to 55: Match the words in column I with their closest opposite in meaning in Column II. For 56 to 60: Choose the correct antonym pair. For 61 to 65: Choose the incorrect antonym pair.

1. Impartial	(a) Hostile	(b) Biased	(c) Dislike	(d) Worried
2. Heartfelt	(a) Loving	(b) Insincere	(c) Unhealthy	(d) Humorous
3. Malodorous	(a) Acrid	(b) Pungent	(c) Fragrant	(d) Delicious
4. Rotund	(a) Round	(b) Unimportant	(c) Thin	(d) Dull
5. Pique	(a) Value	(b) Gully	(c) Smooth	(d) Soothe
6. Brazen	(a) Bashful	(b) Boisterous	(c) Noisy	(d) Heated
7. Irascible	(a) Determined	(b) Placid	(c) Reasonable	(d) Pliant
8. Philistine	(a) Novice	(b) Intellectual	(c) Pious	(d) Debutante
9. Quiescent	(a) Lackadaisical	(b) Active	(c) Dull	(d) Prescient
10. Impecunious	(a) Wealthy	(b) Cautious	(c) Hungry	(d) Tardy
11. Colossal	(a) Easy	(b) Tiny	(c) Graceful	(d) Roof
12. Gumption	(a) Seriousness	(b) Apathy	(c) Levity	(d) Despair
13. Ecstasy	(a) Hate	(b) Agony	(c) Languor	(d) Fatigue
14. Astute	(a) Distraught	(b) Careful	(c) Generous	(d) Gullible
15. Wanton	(a) Merciful	(b) Repast	(c) Brilliant	(d) Vicious
16. Parsimony	(a) Generosity	(b) Sinfulness	(c) Verbosity	(d) Tenderness
17. Recondite	(a) Manifest	(b) Flexible	(c) Provident	(d) Sociable
18. Effluvium	(a) Land	(b) Essential	(c) Fragrance	(d) Solid
19. Repudiate	(a) Argue	(b) Soften	(c) Slander	(d) Admit
20. Pristine	(a) Free	(b) Sullied	(c) Wide	(d) Thorough
21. Prodigal	(a) Thrifty	(b) Secondary	(c) Distant	(d) Squalid
22. Felicitous	(a) Morbid	(b) Boorish	(c) Inopportune	(d) Delightful
23. Adroit	(a) Clumsy	(b) Left	(c) Diplomatic	(d) Unpersuasive
24. Wastrel	(a) Sober	(b) Spendthrift	(c) Mute	(d) Miser
25. Effete	(a) Conquer	(b) Proper	(c) Prosperous	(d) Civilized

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26. Vertiginous	(a) Horizontal	(b) Litigious	(c) Constant	(d) Lowly
27. Entice	(a) Piece	(b) Repulse	(c) Attract	(d) Repeat
28. Delude	(a) Drought	(b) Clever	(c) Enlighten	(d) Enrage
29. Resilient	(a) Stubborn	(b) Careless	(c) Substantial	(d) Flimsy
30. Vacillate	(a) Decide	(b) Teeter	(c) Dilate	(d) Please
31. Tepid	(a) Dispassionate	(b) Scalding	(c) Crisp	(d) Clever
32. Ecumenical	(a) Spiritual	(b) Humanistic	(c) Secular	(d) Parochial
33. Recondite	(a) Give	(b) Obscure	(c) Patent	(d) Hardy
34. Wean	(a) Flourish	(b) Flush	(c) Strengthen	(d) Addict
35. Malice	(a) Goodwill	(b) Bitterness	(c) Coddle	(d) Distress
36. Frivolous	(a) Pious	(b) Inexpensive	(c) Serious	(d) Contemptuous
37. Mendacious	(a) Bashful	(b) Capacious	(c) Veracious	(d) Quiet
38. Indolent	(a) Industrious	(b) Complimentary	(c) Native	(d) Smooth
39. Fortuitous	(a) Undefended	(b) Gratuitous	(c) Deliberate	(d) Impoverished
40. Epicurean	(a) Ascetic	(b) Slovenly	(c) Imprecision	(d) Providential
41. Gambol	(a) Trudge	(b) Hedge	(c) Crone	(d) Misplace
42. Traduce	(a) Deduce	(b) Laud	(c) Presuppose	(d) Converge
43. Bridle	(a) Heckle	(b) Dissuade	(c) Vent	(d) Persist
44. Asperity	(a) Moistness	(b) Amenity	(c) Sour	(d) Generosity
45. Lachrymose	(a) Quick	(b) Loquacious	(c) Blithe	(d) Plentiful

46. Match the columns

Column I	Column II
A. Prudent	1. Malicious
B. Expansive	2. Foolish
C. Benign	3. Alienate
D. Acquaint	4. Narrow

(a) A – 2, B – 4, C – 1, D – 3
(b) A – 4, B – 2, C – 1, D – 3
(c) A – 2, B – 4, C – 3, D – 1
(d) A – 2, B – 1, C – 4, D – 3

47. Match the columns

Column I	Column II
A. Aerate	1. Suffocate
B. Venerable	2. Inspirit
C. Daunt	3. Excess
D. Paucity	4. Sophomoric

(a) A – 2, B – 3, C – 4, D – 1
(a) A – 1, B – 4, C – 2, D – 3
(b) A – 3, B – 2, C – 1, D – 4
(c) A – 4, B – 1, C – 2, D – 3

48. Match the columns

Column I	Column II
A. Ample	1. Normal
B. Deviant	2. Stubborn
C. Abolish	3. Insufficient
D. Tractable	4. Establish

(a) A – 2, B – 1, C – 3, D – 4
(b) A – 1, B – 2, C – 4, D – 3
(c) A – 3, B – 1, C – 4, D – 2
(d) A – 1, B – 3, C – 4, D – 2

50. Match the columns

Column I	Column II
A. Confederate	1. Easy
B. Onerous	2. Enemy
C. Sagacity	3. Professional
D. Dilettante	4. Stupidity

(a) A – 1, B – 2, C – 4, D – 3
(b) A – 2, B – 1, C – 3, D – 4
(c) A – 2, B – 1, C – 4, D – 3
(d) A – 2, B – 4, C – 1, D – 3

51. Match the columns

Column I	Column II
A. Unalloyed	1. Euphoric
B. Scurrilous	2. Impure
C. Dyspeptic	3. Attentive
D. Heedless	4. Decent

(a) A – 4, B – 2, C – 1, D – 3
(b) A – 2, B – 4, C – 1, D – 3
(c) A – 2, B – 4, C – 3, D – 1
(d) A – 2, B – 1, C – 4, D – 3

52. Match the columns

Column I	Column II
A. Craven	1. Clumsy
B. Prolix	2. Stalwart
C. Lambent	3. Brief
D. Dexterous	4. Dull

(a) A – 2, B – 3, C – 4, D – 1
(b) A – 3, B – 2, C – 4, D – 1
(c) A – 2, B – 3, C – 1, D – 4
(d) A – 3, B – 1, C – 2, D – 4

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49. Match the columns

Column I	Column II
A. Abound	1. Shod
B. Forsake	2. Dwindle
C. Discalced	3. Dowdy
D. Resplendent	4. Embrace

(a) A – 1, B – 3, C – 2, D – 4
(b) A – 3, B – 1, C – 4, D – 2
(c) A – 2, B – 4, C – 1, D – 3
(d) A – 4, B – 2, C – 3, D – 1

54. Match the columns

Column I	Column II
A. Procrastinate	1. Active
B. Docile	2. Unruly
C. Denigrate	3. Uphold
D. Dormant	4. Hurry

(a) A – 1, B – 4, C – 2, D – 3
(b) A – 1, B – 3, C – 2, D – 4
(c) A – 2, B – 4, C – 3, D – 1
(d) A – 4, B – 2, C – 3, D – 1

55. Match the columns

Column I	Column II
A. Brusque	1. Ignominy
B. Callow	2. Gracious
C. Countenance	3. Deny
D. Cachet	4. Urbane

(a) A – 2, B – 3, C – 1, D – 4
(b) A – 2, B – 4, C – 3, D – 1
(c) A – 4, B – 2, C – 1, D – 3
(d) A – 1, B – 3, C – 4, D – 2

56. Which of the following combinations is correct?
(a) Solvent : Confusing
(b) Disconsolate : Rude
(c) Bent : Curved
(d) Evince : Hide

57. Which of the following combinations is correct?
(a) Vainglorious : Greedy
(b) Iniquitous : Virtuous
(c) Obstreperous : Strict
(d) Ebullient : Aggressive

58. Which of the following combinations is correct?
(a) Imprimatur : Servant
(b) Odium : Trust
(c) Mephitic : Healthy
(d) Halcyon : Advance

53. Match the columns

Column I	Column II
A. Waive	1. Waste
B. Conserve	2. Anticipated
C. Abrupt	3. Retain
D. Erode	4. Restore

(a) A – 3, B – 1, C – 2, D – 4
(b) A – 1, B – 3, C – 2, D – 4
(c) A – 4, B – 2, C – 3, D – 1
(d) A – 2, B – 1, C – 3, D – 4

(a) Facultative : Compulsory
(b) Persiflage : Admiration
(c) Platitudinous : Hilly
(d) Subsequent : Following

60. Which of the following combinations is correct?
(a) Earnest : Release
(b) Impervious : Perfect
(c) Bemuse : Clarify
(d) Accelerate : Deny

61. Which of the following combinations is incorrect?
(a) Conversant : Unprepared
(b) Penurious : Generous
(c) Unctuous : Sincere
(d) Fustigate : Praise

62. Which of the following combinations is incorrect?
(a) Foster : Discourage
(b) Recall : Rebate
(c) Forsake : Embrace
(d) Forced : Natural

63. Which of the following combinations is incorrect?
(a) Tragic : Comic
(b) Able : Inept
(c) Tireless : Exhausted
(d) Haste : Flurry

64. Which of the following combinations is incorrect?
(a) Permanent : Fleeting
(b) Attain : Lose
(c) Taint : Clear
(d) Belittle : Magnify

65. Which of the following combinations is incorrect?

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59. Which of the following combinations is correct?

(a) Tedious : Horrible
(b) License : Restriction
(c) Denounce : Covet
(d) Contrary : Agreeable

2.2 Phrasal Verbs

Phrasal verbs are verbs that consist of a verb and a particle (a preposition or adverb) or a verb and two particles (an adverb and a preposition). They are identified by their grammar, but it is probably best to think of them as individual vocabulary items. Some important phrasal verbs with their meaning is given in the list below.

Phrasal Verb	Meaning
abide by	to accept or obey an agreement, decision or rule
account for	to explain the reason for something or the cause of something
ache for	to want something very much
act on	to act without being told to by someone in authority
act out	to perform the actions and say the words of a situation or story
act up	if a person, especially a child, acts up, they behave badly
act upon	to take action because of something like information received
add on	an extra part which is added to an officially organized plan or system, etc.
add up	to calculate the total of two or more numbers:
angle for	trying to get something without asking for it directly
answer for	to be responsible for something bad, or to be punished for something
back out	to decide not to do something that you had said you would do
bail out	to stop doing or being involved with something
bargain for	to expect or be prepared for something
barge in	to walk into a room quickly, without being invited
bawl out	to tell someone angrily that something they have done is wrong
be after	to be looking for someone or something or trying to find or get them
be along	to join in an activity without playing an important part in it
not be cut out for	to not be the right type of person for something
be cut up	be cut up
be down	to be written down
be loaded with	to contain a lot of something
be in	to be going to experience something unpleasant very soon
be etched on	to be something that you will continue to remember
bear down on	to move in a threatening way towards someone or something
bear out	to support the truth of something
bear up	to deal with a very sad or difficult situation in a brave and determined way
bear with	to be patient and wait while someone does something
beat down	to persuade someone to accept a lower amount of money for something
beat out	to defeat someone or do better than them in a competition, sport or business
bed down	to lie down somewhere in order to go to sleep
bed out	to move young or delicate plants from inside and plant them outside
belt out	to sing or play a musical instrument very loudly
belt up	used to tell someone to stop talking or making a noise
bend over	to try very hard to do something
big up	to talk a lot about how excellent someone or something is
black out	to cover a face or a name so that it cannot be seen
blank out	to intentionally cover over something that is written so that it cannot be read
block in	to put a vehicle so close to another vehicle that it cannot drive away
block off	to close a road, path or entrance so that people cannot use it

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Phrasal Verb	Meaning
block out	to stop light or noise from passing through something
block up	to fill a narrow space with something so that nothing can pass through
blow away	to surprise or please someone very much
blow off	to treat something or someone as if they are not important
blow out	to disappoint someone by not meeting them
blow over	to becomes gradually less important until it ends and is forgotten
blurt out	to say something suddenly and without thinking
board up	to cover a door or window with wooden boards
bog off	to go away
boil down	to heat something so that part of it is turned into gas and its amount is reduced
boil over	when people lose their tempers and things get nasty
bottle up	to refuse to talk about things that make them angry or worried
bounce off	to tell someone about an idea or plan in order to find out what they think of it
break away	to leave or to escape from someone who is holding you
break down	to be unable to control your feelings and to start to cry
break off	to separate a part from a larger piece, or to become separate
break out	to suddenly have spots or sweat appear on your skin
break through	to force yourself through something that is holding you back
break up	a gradual division into smaller pieces
brick up	to build a wall of bricks around something, or to fill something with bricks
bring about	to cause something to happen
bring along	to take someone or something with you
brink back	to return from somewhere with something
bring forward	to change the date or time of an event so that it happens earlier than planned
bring in	to introduce something new such as a product or a law
bring off	to succeed in doing something difficult
bring on	to make something happen, usually something bad
bring out	to make a shy person happier and more confident
bring round	to make someone become conscious again after being unconscious
bring up	to care for a child until it is an adult, often giving it particular beliefs
brush up	to improve your knowledge of something already learned but partly forgotten
build up	to praise someone in a way which will influence people's opinions
bulk out	to make something bigger or thicker by adding something
burn down	to destroy something, especially a building, by fire, or to be destroyed by fire
burn off	to use or get rid of energy or fat by doing a lot of physical exercise
burn out	extreme tiredness usually caused by working too much
burn up	to use or get rid of energy or fat by doing a lot of physical exercise
burst into	to enter a room or building suddenly and without warning
bust up	a serious argument, especially one which ends a relationship
buy into	to completely believe in a set of ideas
buy off	to pay someone so that they do not cause you any trouble
buy out	to buy a part of a company or building from other so that you own all of it
buzz off	to go away
call back	to return to a place in order to see someone or collect something
call for	to go to a place in order to collect someone
call off	to order a dog, or sometimes a person, to stop attacking someone or something
call on	to visit someone for a short time
carry away	to become so excited about something that you do not control what you do
carry off	to succeed in doing or achieving something difficult
carry over	to include an amount of money in a later set of calculations
carry through	to help someone be able to deal with a difficult situation

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Phrasal Verb	Meaning
carve out	to successfully create or obtain something
carve up	to divide something into smaller parts
cash in	to get an advantage from an event or situation, often in an unfair way
cash up	to count all the money taken by a shop or business at the end of each day
cast aside	to get rid of someone or something
cast out	to get rid of someone or something, especially forcefully
catch on	to become fashionable or popular
catch out	to show that someone is doing wrong
catch up	to reach someone in front of you by going faster than them
cave in	to agree to something that you were against before
chase up	to try to get more information about the progress of something
check off	to mark names or items on a list as correct or as having been dealt with
check out	to go to a place in order to see what it is like
cheer on	to shout loudly in order to encourage someone in a competition
cheer up	to make a place look brighter or more attractive
chew out	to tell someone angrily that they have done something wrong
chew over	to think about or discuss something carefully for a long time
chip in	to interrupt a conversation in order to say something
chop down	to cut through something to make it fall down
chuck away	to throw something away
chuck in	to stop doing something which was a regular job or activity
chuck out	to throw something away
clam up	to go silent suddenly
claw back	to obtain possession of something again with difficulty
clean out	to take everything out of a room, car, container, etc.
clean up	to stop illegal or dishonest activity in a place or organization
clear out	to leave a place
clear up	to make a place tidy by removing things from it
climb down	to change your opinion or admit that you were wrong
cling on	to try very hard to keep something
cling to	to try very hard to keep something
close in	to gradually get nearer to someone, usually in order to attack them
cobble together	to do or make something quickly and not very carefully
come along	to arrive or appear at a place
come apart	to separate into several pieces
come at	to move towards someone in order to attack them
come down	to fall and land on the ground
come off	to happen as planned or to succeed
come on	to be seen on stage in a play or to be heard in a radio programme
come over	to be influenced suddenly and unexpectedly by a strange feeling
come round	to visit someone in their home
come up	to be mentioned or talked about in conversation
come upon	to find something or meet someone unexpectedly
conk out	to go to sleep very quickly, or to suddenly become unconscious
contract in	to formally agree to take part/stop taking part in an official plan or system
contract out	to formally arrange for other people to do a particular job
cool down	to stop feeling angry after an argument
coop up	to keep someone or something in an enclosed space
cotton on	to begin to understand a situation or fact
count in	to include someone in an activity or arrangement
count on	to be confident that you can depend on someone

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Phrasal Verb	Meaning
count out	to count coins or notes one by one as you put them down
crack down	to start dealing with bad or illegal behaviour in a more severe way
crack on	to become mentally ill
crank up	to increase or improve something
crash out	to go to sleep very quickly because you are very tired
cream off	to remove the best part of something
cry off	to decide not to do something that you have arranged to do
cry out	to shout or make a loud noise because you are frightened, hurt, etc.
cut across	to go straight from one side of an area to another instead of going round
cut back	to do less of something or use something in smaller amounts
cut in	to interrupt what someone is saying by saying something yourself
cut it out	used to tell someone to stop talking or stop behaving in an annoying way
cut out	to not allow someone to share something or be included in something
cut up	to cut something into pieces
damp down	to make a fire burn more slowly
dash off	to write something quickly, putting little effort into it
dawn on	to become aware of something after a period of not being aware of it
die away	to gradually reduced something until it stops existing or disappears
die for	excellent or extremely desirable
die out	to become less common and finally stop existing
dig in	to make arrangements to protect yourself from an attack by the enemy
dig into	to press or push, or to press or push an object, hard into someone or something
dig out	to get someone or something out of somewhere by digging
dig up	to take something out of the ground by digging
dine out	to go to a restaurant to eat your evening meal
dine out on	to entertain people at a meal by telling them about an experience you have had
dip in	to put your hand into a container and take something out
dish out	to give or say things to people without thinking about it carefully
dish up	to produce or serve a meal
dive in	to start doing something suddenly often without stopping to think
do in	to attack or kill someone
do out of	to stop someone from getting something in a dishonest or unfair way
do up	to fasten something or become fastened
do with	to get rid of something or stop using something
dob in	to secretly tell to the authority that someone else has done something wrong
dole out	to give something, usually money, to several people
drag on	to slow down or limit the development of someone or something
draw back	to move away from something because you are surprised or frightened
draw in	to becomes darker earlier because autumn or winter is coming
draw into	to make someone become involved in a difficult or unpleasant situation
draw on	to use information or your knowledge of something to help you do something
draw out	to cause something to last longer than is usual or necessary
draw up	to prepare something, usually something official, in writing
dream of	to think about something that you want very much
dream up	to invent something very imaginative and usually silly
drift off	to gradually start to sleep
drive off	to gradually start to sleep
drive up the wall	to make someone extremely angry
drone on	to talk for a long time in a boring way
drop by	to visit someone
drop off	to start to sleep

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Phrasal Verb	Meaning
drown in	to have more of something than you are able to deal with
drown out	if a loud noise drowns out another noise, it prevents it from being heard
drum into	to teach something to someone by repeating it to them frequently
drum out	to force someone to leave a job, group, etc.
drum up	to increase interest in something or support for something
dry off	to make someone or something dry on the surface
dry out	someone who dries out stops being dependent on alcohol
dry up	if a supply of something dries up, it ends
duck out of	to avoid doing something
duff up	to hit someone repeatedly
dwell on	to keep thinking or talking about something
ease off	to gradually stop or become less
eat away	to gradually damage or destroy something
eat into	to use or take away a large part of something valuable, such as money or time
eat up	to use or take away a large part of something valuable
egg on	to encourage someone to do something which might not be a very good idea
end up	to finally be in a particular place or situation
enter into	to start to become involved in something, especially a discussion or agreement
eye up	to look at someone with sexual interest
fall about	to laugh uncontrollably
fall apart	to break into pieces
fall back on	to use something for help because no other choice is available
fall for	to suddenly have strong romantic feelings about someone
fall into	to start doing something, often without intending to
fall off	to become smaller or lower in amount or rate
fall out	to argue with someone and stop being friendly with them
fall over	to cover something or someone
fall through	to fail to happen
farm out	to give work to other people to do
fart about	to waste time doing silly or useless things
fasten on	to give attention to something, because it is of special interest
feed off	to use something to succeed or get advantages
feed up	to make a person or animal healthier or fatter by giving them lots of food
feel up	to touch someone sexually, whom you do not know, for your own excitement
fend for	to take care of and provide for yourself without depending on anyone else
fend off	to push or send away an attacker or other unwanted person
filter in	to join a line of moving traffic without causing other vehicles to slow down
find out	to discover that someone has done something wrong
finish off	to complete the last part of something that you are doing
finish up	to stop using or needing something
fire off	to write and send an angry letter to someone
fire up	to make someone become excited or angry
firm up	to make something more definite or less likely to change
fish out	to pull something out of water or take something out of a bag or pocket
fit in	to find time to do or deal with something or someone
fit out	to supply someone or something with all of the things which will be needed
fit up	to put furniture in a room or building
fix up	to arrange a meeting, date, event, etc.
flag down	to cause a vehicle to stop by waving at its driver
flake out	to suddenly fall asleep or feel weak because you are extremely tired
flesh out	to add more details or information to something

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Phrasal Verb	Meaning
flick through	to look quickly at the pages of a magazine, book, etc.
fly at	to attack another person or animal suddenly
follow through	to do something as the next part of an activity or period of development
fool about	to behave in a silly way, especially in a way that might have dangerous results
frown on	to disapprove of something
gang up	to unite as a group against someone
gear up	to prepare for something that you have to do
get about	to travel to a lot of places
get across	to manage to make someone understand or believe something
get ahead	to be successful in the work that you do
get along	to deal with a situation, usually successfully
get at	to criticize a person repeatedly in a way that makes them unhappy
get away	to leave or escape from a person or place, often when it is difficult to do this
get away with	to succeed in avoiding punishment for something
get back	to return to a place after you have been somewhere else
get behind	to fail to do as much work as you should by a particular time
get by	to be able to live or deal with a situation with difficulty
get down	if something gets you down, it makes you feel unhappy and dissatisfied
get down to	to start to direct your efforts and attention towards something
get in	to succeed in entering a place, especially by using force or a trick
get in on	to start to take part in an activity that is already happening
get into	to succeed in being chosen or elected
get it together	to make a decision or take positive action in your life
get off	to leave a train, bus or aircraft
get off on	to find something exciting, especially in a sexual way
get off with	to begin a sexual relationship with someone
get on	to manage or deal with a situation, especially successfully
get on to	to start talking about a different subject
get out of	to avoid doing something that you do not want to do by giving an excuse
get over	to feel better after something or someone has made you unhappy
get over with	to do or finish an unpleasant but necessary piece of work
get round	to persuade someone to allow you something by charming them
get through	to succeed in talking to someone on the telephone
get through to	to succeed in making someone understand or believe something
get to	to makes you suffer
get up to	to do something, often something that other people would disapprove of
give in	to finally agree to what someone wants, after refusing for a period of time
give off	to produce heat, light, a smell or a gas
give onto	to open in the direction of something
give out	if a machine or part of your body gives out, it stops working
give over	to stop doing something, usually something annoying
give over to	to give another person the use of something
give up	to spend all your time and energy doing or feeling something
give way to	to be replaced by something because it is better, cheaper, easier, etc.
go about	to begin to do something or deal with something
go after	to chase or follow someone in order to catch them
go against	to oppose or disagree with something or someone
go along with	to support an idea, or to agree with someone's opinion
go back	to have existed since a time in the past
go back on	to fail to keep a promise, or to change a decision or agreement
go by	to move past, in space or time

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Phrasal Verb	Meaning
go down	to move down to a lower level or place
go down with	to start to suffer from an infectious disease
go for	to attack someone
go for it	to do anything you have to in order to get something
go in	to enter a place
go in for	to take part in a competition
go into	to start doing a particular type of work
go it alone	to do something without other people
go off	to happen in a particular way
go off with	to take something without obtaining permission from the owner first
go on	to start operating
go over	to examine or look at something in a careful or detailed way
go over to	to change to something new or to a new way of doing things
go through	to experience a difficult or unpleasant situation
go through with	to do something unpleasant that has already been agreed or promised
go to	to be given or sold to someone
go together	to look good together
go under	to sink
go up	the quality of being positive and having lots of new ideas and energy
go up to	to reach as far as something
grasp at	to try to take an opportunity
grow into	to develop into a particular type of person or thing
grow up	to gradually become an adult
hack off	to make someone feel annoyed
ham it up	to perform or behave in a false way
hand in	to give something to someone in a position of authority
hand out	to give something to each person in a group or place
hand over	to give something to someone else
hang about	to move or do things slowly
hang around	to move or do things slowly
hang back	to be slow to do something, often because of fear or lack of confidence
hang on	to wait for a short time
hang out	to spend a lot of time in a place or with someone
hang up	to end a telephone conversation
harp on	to talk or complain about something many times
have against	to dislike someone for a reason
have on	to persuade someone that something is true when it is not, usually as a joke
have up	to take someone to court for a trial
head off	to start a journey or leave a place
hear of	to receive news about someone
hear out	to listen to someone until they have said everything they want to say
hit on	to show someone that you are sexually attracted to them
hit up	to ask someone for something
hive off	to separate one part of a company, usually by selling it
hold back	to keep information secret from someone on purpose
hold down	to keep someone or something in a particular place or position
hold off	to not do something immediately
hold on	to wait for a short time
hold on to	to keep something you have
hold out	to offer a possibility, solution, hope etc.
hole up	to stay in a safe place, often as a way of escape

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Phrasal Verb	Meaning
home in on	to aim for
hunt down	to search everywhere for someone or something until you find them
hush up	to try to prevent people from discovering particular facts
iron out	to remove problems or find solutions
jack up	to raise a heavy object such as a car off the ground with a jack
jot down	to write something quickly on a piece of paper so that you remember it
jump at	to accept something eagerly
jump in	to interrupt when someone else is speaking
keep at	to not allow someone to become too friendly with you
keep away	to not go somewhere or near something
keep back	to prevent someone or something from going past a particular place
keep down	to be able to eat or drink something without vomiting
keep from	to prevent someone or something from doing something
keep in	to make someone stay in hospital
keep off	to not go onto an area
keep to	to do what you have promised or planned to do
keep up	to not allow something that is at a high level to fall to a lower level
key in	to put information into a computer or a machine using a keyboard
key to	to plan something so that it is suitable for a particular person or situation
kick in	to start to have an effect or to happen
kick out	to force someone to leave a place or organization
knock about	to behave violently towards someone and hit them
knock back	to cost someone a large amount of money
knock down	to hit someone with a vehicle and injure or kill them
knock off	to stop working, usually at the end of the day
knock out	to hit someone so that they become unconscious
knock together	to make something quickly and without much care
knuckle down	to start working or studying hard
knuckle under	to accept someone's power over you and do what they tell you to do
land in	to cause someone to be in a difficult situation
land with	If someone lands you with something, they cause problems for you
lap up	to enjoy something very much
lay down	to officially establish a rule in which something should be done
lay into	to attack someone physically or to criticise them in an angry way
lay on	to provide something for a group of people
lay out	to arrange something on a flat surface
lead on	to persuade someone to believe something that is untrue
lead to	if an action or event leads to something, it causes that thing to happen or exist
lean on	to use someone or something to help you, especially in a difficult situation
leap at	to eagerly accept the chance to do or have something
leave out	to not include someone or something
let down	to disappoint someone by failing to do what you agreed to do
let off	to not punish someone who has committed a crime
let on	to tell someone about something that is secret
let out	to allow someone or something to leave a place
lie around	to left in places where they should not be
lighten up	to make a speech or piece of writing less serious
listen up	something you say to make people listen to you
live for	to have something or someone as the most important thing in your life
live it up	to have an exciting and very enjoyable time with parties, good food and drink
live up to	to be as good as something

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Phrasal Verb	Meaning
live with	to accept a difficult or unpleasant situation
lock out	to prevent someone from entering a building or room by locking the door
lock up	a building where objects, especially a car, can be safely kept
look down on	to think that someone is less important than you
look out for	to try to notice someone or something
look forward to	to feel pleased and excited about something that is going to happen
look into	to examine the facts about a problem or situation
look on	to watch something happen but not become involved in it
look on as	to consider or think of someone or something as something
look out	to watch what is happening and be careful
look over	to quickly examine something or someone
look round	to visit a place and look at the things in it
look through	to read something quickly
lose out	to not have an advantage that other people have
luck into	to get something that you want by chance
luck out	to be very lucky
lust after	to want something very much
make for	to result in or make possible
make into	to change something into something else
make off	to leave quickly, usually in order to escape
make out	to see, hear or understand something or someone with difficulty
make towards	to go in the direction of something or someone
make up to	to be too friendly to someone or to praise them in order to get advantages
make with	to give, bring or do something
mark down	to reduce the price of something in order to encourage people to buy it
mark out	to increase the price of something
mark up	the amount by which the price of something is increased before it is sold again
mash up	to crush something, especially food
measure out	to measure a small amount of something from a larger amount of something
measure up	to be good enough, or as good as someone or something else
meet with	to experience something, usually something unpleasant
mess about	to treat someone badly
mess up	something which has been done badly
mess with	to treat someone in a bad, rude or annoying way
mete out	to give a punishment or make someone receive cruel or unfair treatment
miss out	to fail to include someone or something that should be included
mix up	a mistake that causes confusion
mop up	to use a cloth or a mop to remove liquid from the surface of something
mount up	to gradually become a large amount
mouth off	to express your opinions too loudly and publicly
move on	to change from one subject to another when talking or writing
move out	to stop living in a particular home
muddle up	to arrange things in the wrong order
mug up	to study a subject quickly before taking an exam
mull over	to think carefully about something for a long time
nail down	if you nail down an arrangement, you fix and agree to the details of it
nod off	to begin sleeping, especially not intentionally
nose out	to discover something by searching carefully
note down	to write something so that you do not forget it
open up	to make a space larger or less enclosed
opt out	to choose not to be part of an activity or to stop being involved in it:

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Phrasal Verb	Meaning
owe it to yourself	to deserve and need to do something which will be good for you
own up	to admit that you have done something wrong
pack in	to stop doing something
pack off	to send someone to another place
pack out	to make a place very full
pack up	to stop working or doing another regular activity
pair up	to join together temporarily with another person in order to do something
palm off	to give away something because you do not want it
pan out	to develop in a particular way or in a successful way
paper over	to hide an unpleasant situation
part with	to give something to someone else, especially when you do not want to
pass as	to appear to be someone or something else
pass down	to teach or give something to someone who will be alive after you have died
pass for	to appear to be someone else, or to cause people to believe that they are
pass off	to happen
pass on	to tell someone something that another person has told you
pass out	to become unconscious for a short time
pass over	to ignore or to not give attention to someone or something
pass round	to offer something to each person in a group of people
pass up	to fail to take advantage of an opportunity
patch together	to arrange something very quickly but not very carefully
patch up	to try to improve a relationship after there have been problems
pay back	to pay someone the money that you owe them
pay for	to be punished for doing something bad to someone else
phase in	to introduce something gradually or in stage
phase out	to remove or stop using something gradually or in stages
pick at	to eat only a little bit of your food
pick off	to shoot at one particular thing which you have chosen from a group
pick on	to criticize, punish or be unkind to the same person frequently and unfairly
pick out	to recognize, find or make a choice among different people or items in a group
pick up	the act of picking someone or something up, or the place where it happens
pin down	to make someone provide details about something
pin on	to blame someone for something, especially for something they did not do
pipe down	to stop talking or making unnecessary noise
pipe up	to suddenly start to speak or make a noise
pit against	to cause group or thing to fight against or be in competition with another
play off	to play a game, in a team sport, to decide which side will win
play out	to pretend that an imaginary situation or event is really happening
play up	to cause someone pain
play with	to consider an idea or plan
plough back	to spend the money that a business has earned on improving that business
plough on	to continue doing something although it is difficult or boring
plough through	to go through a substance or an area of something with difficulty
pluck at	to pull something with fingers again and again, using quick, small movements
polish off	to finish something quickly and easily, especially a lot of food or work
polish up	to rub or brush an object to make it shine, especially a metal or wooden object
poop out	to become very tired and unable to continue working or operating
pop off	to die
pore over	to look at and study something, usually a book or document, carefully
press on	to give something to someone and not allow them to refuse to accept it
prey on	to hurt or deceive a group of people, especially people who are weak

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Phrasal Verb	Meaning
pull apart	to separate two things or people
pull off	to succeed in doing something difficult or unexpected
pull on	to put on clothes quickly
pull out	to stop being involved in an activity or agreement
pull through	to become well again after a serious illness
pull to	to criticize someone or something severely
pull together	to become calm and behave normally again after being angry or upset
pull up	to tell someone that they have done something wrong
put across	to cause a piece of false information to be believed by one or more people
put away	to put something in the place or container where it is usually kept
put back	to return an object to where it was before it was moved
put by	to save an amount of money to use later
put down	an unkind remark that makes someone seem foolish
put in	to fix a large piece of equipment or system into a building, ready to be used
put off	to decide or arrange to delay an event or activity until a later time or date
put out	to make a light stop shining by pressing a switch
put over	to cause a piece of false information to be believed by one or more people
put through	to make someone experience something unpleasant or difficult
put towards	to use an amount of money to pay part of the cost of something
rain off	if an event is rained off, it cannot start or continue because it is raining
rake over	to keep talking or thinking about an unpleasant event or experience
rake up	to get the things or people you need, with difficulty
rat on	to be not loyal to someone by giving away secret information about them
rattle off	to say or read aloud very quickly a list of names or items
reel in	to pull in a rope on the end of a rope by turning a wheel round and round
reel off	to say a long list of things quickly and without stopping
rip off	something that is not worth what you pay for it
roll back	to reduce the cost or price of something
roll in	to arrive in great numbers or amounts
roll out	to make a new product, service or system available for the first time
root about	to search for something, especially by looking through other things
root out	to search and find something or someone that is difficult to find
root up	to remove a whole plant, including the roots, from the ground
round off	to complete an event or activity in a pleasant or satisfactory way
rule out	to prevent something from happening
run across	to meet someone you know when you are not expecting to
run against	to oppose or have an effect that is not helpful towards someone or something
run around	to be very busy doing a lot of different things
run down	a detailed report
run in	have a serious argument with them or you get into trouble with them
run into	to drive a vehicle accidentally into an object or a person in another vehicle
run off	an extra competition or election to decide the winner
run away	to leave a place or person secretly and suddenly
rush off	to cause someone to be very busy
rush out	to very quickly produce something and make it available to sell
sail into	to start an activity enthusiastically
salt away	to save something, often money, secretly
save on	to avoid using something so that you do not have to pay for it
save up	to keep money so that you can buy something with it in the future
screen of	to separate one area from another using a wall or other vertical structure
screw up	to make a mistake, or to spoil something

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Phrasal Verb	Meaning
see about	to prepare for or deal with an action or event
see off	to go to the place that someone is leaving from in order to say goodbye
see out	to wait or last until the end of a difficult event or situation
send in	to send something to an organization
send for	to send someone a message asking them to come to see you
send out	to send something to a lot of different people, usually by post
send down	to send someone to prison
set about	to start to do or deal with something
set back	to delay an event, process or person
set on	to attack someone
set out	to start a journey
set to	a short argument or fight
settle down	to become familiar with a place and to feel happy and confident in it
settle in	to agree on a decision
settle up	to pay someone the money that you owe them
shake off	to get rid of an illness
shave off	to reduce something by the stated amount
shell out	to pay or give money for something, usually unwillingly
ship off	to send someone away somewhere
show up	to arrive somewhere in order to join a group of people, especially late
shut away	to put a person in a place which they are not permitted or able to leave
shut in	to trap part of your body or an object inside a device when it closes
shut out	to prevent a sound or light from being heard or seen
side with	to support one person or group in an argument
sign away	to give up your rights to something by signing a legal document
sign for	to sign a form to show that you have received something
sign off	to stop doing your work or a similar activity for a period of time
sit back	to sit comfortably with your back against the back of a chair
sit by	to fail to take action to stop something wrong from happening
sit in	to be present in a meeting or class, watching it but not taking part in it
sit on	to delay taking action about something
sit with	to be something that you agree or are pleased with
size up	to examine someone carefully and decide what you think about them
slag off	to criticize someone
slip into	to quickly put on a piece of clothing
slip out of	to quickly take off a piece of clothing
slow down	to be less active and relax more
sniff at	to show disapproval or a low opinion of something
sniff out	to discover where something or someone is by smelling
snuff out	to cause something to end suddenly
sober up	to become less drunk, or to make someone become less drunk
spill out	to flow or fall out of a container
spill over	to continue for a longer time than expected
spin off	a product that develops from another more important product
spirit away	to move someone or something out of or away from a place secretly
spit out	to say something quickly and angrily
splash out	to spend a lot of money on buying things
spring from	to come from or be a result of something
spring on	to suddenly tell or ask someone something when they do not expect it
stack up	to compare with another thing of a similar type
stamp out	to get rid of something that is wrong or harmful

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Phrasal Verb	Meaning
stand about	to spend time standing somewhere and doing very little
stand aside	to leave a job or position so that someone else can have it instead:
stand back	to move a short distance away from something or someone
stand by	to be waiting and ready to do something or to help
stand down	to give up your official job or position
stand for	to support or represent a particular idea or set of ideas
stand out	to be very noticeable
stand up	describes comedy performed by a single person telling jokes
start off	to begin by doing something, or to make something begin by doing something
start on	to start to deal with something, or to start to use something
start over	to begin to do something again, sometimes in a different way
stay in	to stay in your home
stay on	to continue to be in a place after the other people who were with you have left
stay out	to not come home at night, or to go home late
stay up	to go to bed later than usual
stick at	to continue trying hard to do something difficult
stick by	to continue to support something or someone, especially in a difficult situation
stick out	to go beyond the surface or edge of something
stick up	the act of threatening someone with a gun in order to steal from them
stop by	to visit someone briefly, usually on the way to another place
strike back	to attack someone who has attacked you
strike down	to rule that a law is illegal and should not be obeyed
strike on	to discover or think of something
strike out	to start on a long or difficult journey in a determined way
strike up	to start to play or sing something
strike upon	to discover or think of something
swear by	to believe strongly that something is effective or useful
tail off	to decrease in amount or become lower in level
take after	to be similar to an older member of your family in appearance or character
take apart	to separate something into its different parts
take back	to admit that something you said was wrong
take down	to write something that another person has just said
take in	to include something
take off	to spend time away from your work
take on	to accept a particular job or responsibility
take out	to kill someone or destroy something
take to	to start to like someone or something
take up	to discuss something or deal with something
talk around	to avoid speaking directly about something
talk at	to speak to someone without listening to them or allowing them to speak
talk down	to speak loudly or without stopping to prevent someone else from speaking
talk into	to persuade someone to do something
talk out	to persuade someone not to do something
tap for	to get money from someone
tear apart	to pull something so violently that it breaks into two or more pieces
tear into	to criticize someone or something very strongly
tear off	to leave very quickly
tear up	to tear paper into a lot of small pieces
throw off	to escape from something or someone following you
throw out	to get rid of something that you do not want any more
throw over	to finish a relationship with someone and start one with another person

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Phrasal Verb	Meaning
throw up	to vomit
tip off	a secret warning or piece of secret information
tip over	to fall over onto one side
tire of	to become bored with someone or something, or to stop enjoying an activity
tire out	to make someone very tired
top off	to finish something in an enjoyable or successful way
touch off	to cause a violent or difficult series of events to suddenly begin
touch on	to mention a subject briefly when speaking or writing about another subject
touch up	to improve something by making small changes or additions
track down	to find someone after looking for them in a lot of different places
trade on	to use something for your own advantage and usually in an unfair way
tune out	to ignore someone or not give your attention to something
turn against	to start not to like or agree with someone or something
turn away	to not allow someone to enter a place
turn down	to refuse an offer or request
turn in	to return something to an organization or a person in authority
turn off	to leave the road you are travelling on and travel along another one
turn on	something which you find exciting
turn out	to be known or discovered finally and surprisingly
turn over	to change to a different television station
turn up	to discover something, especially information, after a lot of searching
urge on	to encourage someone to do or achieve something
use up	to finish a supply of something
wait around	to stay in a place and do nothing while you wait for someone to arrive
wait on	to do everything for someone so that they do not have to do anything
wait up	to not go to bed at night because you are expecting someone to arrive
walk into	to get a job very easily
walk off	to leave a place because you are angry or dissatisfied about something
walk out	to stop working because of a disagreement with your employer
walk through	to slowly and carefully explain something to someone
waste away	to gradually get thinner and weaker, in a way that is unhealthy
watch over	to protect someone and make certain that they are safe
wave down	to make a driver stop their vehicle by waving your arms up and down
wave off	to wave to someone as they leave a place in order to say goodbye
wean off	to make someone gradually stop using something that is bad for them
wear away	to become thin and disappear after repeated use or rubbing,
wear out	to make someone extremely tired
weed out	to get rid of unwanted things or people from a group
weigh in	to become involved in an argument or discussion in a forceful way
wind down	to end gradually or in stages, or to cause something to do this
wind up	to annoy or upset someone
wipe out	to destroy something completely
work on	to spend time repairing or improving something
work out	to be the result of a calculation
work over	to attack and injure someone
wrap around	made so that it can be tied around the body
wrap up	to cover or enclose something in paper, cloth or other material
write off	to decide that a particular person or thing will not be important or successful
write up	to write something in a complete or final form using notes that you have made
yield to	to agree to do something that you do not want to do or should not do
zoom in	focus more closely
zoom out	focus less closely

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zoom in on	to notice and give special attention to something

In the following questions choose the correct option which is closest similar meaning of the underlined word in the given sentence.

Example [GA-2013 (1 mark)]: They were requested not to quarrel with others.
(a) make out (b) call out (c) dig out (d) fall out
Solution (d): Quarrel means 'an angry disagreement between two or more people or groups'; make out means 'to see, hear or understand something or someone with difficulty'; call out means 'to say in a loud voice'; dig out means 'to find something that you have not seen or used for a long time'; fall out means 'to argue with someone and stop being friendly with them'.

Example [GA-2014 (1 mark)]: It is fascinating to see life forms cope with varied environmental conditions.
(a) adopt to (b) adapt to (c) adept in (d) accept with
Solution (b): cope with means 'to struggle or deal, especially on fairly even terms or with some degree of success'; adopt to means 'to take on the legal responsibilities as parent'; adapt to means 'to alter something so that it is better suited to something else'; adept in means 'to have a natural ability to do something that needs skill'; accept with means 'to take or receive with approval or favour'.

Example [GA-2015 (2 mark)]: Select the alternative meaning of the underlined part of the sentence.
The chain snatchers took to their heels when the police party arrived.
(a) took shelter in a thick jungle (b) open indiscriminate fire
(c) took to flight (d) unconditionally surrendered
Solution (c): 'took to their heels' means 'to run away quickly'. So we choose option (c), i.e., 'took to flight' which means 'to run away quickly'.

Example [GA-2016 (1 mark)]: After India's cricket world cup victory in 1985, Shrotria who was playing both tennis and cricket till then, decided to concentrate only on cricket. And the rest is history. What does the underlined phrase mean in this context?
(a) history will rest in peace (b) rest is recorded in history books
(c) rest is well known (d) rest is archaic
Solution (c): 'Rest is history' is an idiomatic expression which means 'everything which happened since then is well known'. So option (c) is correct.

Example [GA-2016 (1 mark)]: Nobody knows how the Indian cricket team is going to cope with the difficult and seamer-friendly wickets in Australia. Choose the option which is closest in meaning to the underlined phrase in the above sentence.
(a) put up with (b) put in with (c) put down to (d) put up against
Solution (a): 'cope with' means 'to deal successfully with a difficult situation'.
'put up with' means 'to accept or continue to accept an unpleasant situation or experience, or someone who behaves unpleasantly'.
'put in with' means 'to commit to something with or to partner with'
'put down to' means 'to think that a problem or situation is caused by a particular thing'
'put up against' means 'to place someone into competition with someone else'
Hence now we can conclude that option (a) is correct.

Example [GA-2016 (1 mark)]: He turned a deaf ear to my request. What does the underlined phrasal verb mean?
(a) ignored (b) appreciated (c) twisted (d) returned
Solution (a): Since 'turn a deaf ear to' means 'to ignore what someone is saying'; so option (a) is correct.

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Example [GA-2016 (1 mark)]: The chairman requested the aggrieved shareholders to _____ him.
(a) bare with (b) bore with (c) bear with (d) bare
Solution (c):
'Bear with' means 'to be patient and wait while someone does something', so option (c) is correct.

Exercise 2.3

Choose the correct phrasal verb which is closest similar in meaning of the underlined word in the given sentence.

1. **They just <u>ignored</u> my complaints; it made me very angry.**
   (a) pass over (b) blow up (c) call off (d) give away
2. **If you are phoning from outside the country, <u>omit</u> the first zero in the city code.**
   (a) throw away (b) drop by (c) leave out (d) pass out
3. **Crowds of <u>onlookers</u> watched as the police arrested the man.**
   (a) look see (b) look down (c) look upon (d) look on
4. **Some prisoners <u>escaped</u> from the jail last week.**
   (a) broke in (b) broke up (c) broke away (d) broke off
5. **Two police cars <u>stopped</u> outside the door.**
   (a) drew out (b) drew on (c) drew up (d) drew off
6. **A rocket will have <u>started</u> on its Mars trip.**
   (a) set up (b) set off (c) set aside (d) set about
7. **The terrorist tried to <u>explode</u> the railroad station.**
   (a) blow off (b) blow in (c) blow over (d) blow up
8. **The lawyers <u>examine</u> the papers carefully before questioning the witness.**
   (a) look on (b) look out (c) look over (d) look out
9. **We asked the boss to <u>postpone</u> the meeting until tomorrow.**
   (a) put by (b) put across (c) put out (d) put off
10. **I <u>tested</u> four cars before I could find one that pleased me.**
    (a) try out (b) try on (c) try back (d) try it on
11. **He applied for a promotion twice this year, but he was <u>rejected</u> both times.**
    (a) turn away (b) turn down (c) turn in (d) turn into
12. **The old minister continued to <u>visit</u> his sick parishioners.**
    (a) call for (b) call in (c) call on (d) call off
13. **The students <u>reviewed</u> the study material before the examination.**
    (a) go on (b) go off (c) go for (d) go over
14. **The police will <u>investigate</u> the possibilities of embezzlement.**
    (a) look into (b) look after (c) look in (d) look out
15. **My second son seems to <u>resemble</u> his mother.**
    (a) take apart (b) take after (c) take on (d) take over
16. **The citizens tried to <u>eliminate</u> their corrupt mayor in the recent election.**
    (a) get rid of (b) get around (c) get at (d) get behind
17. **They tried to <u>enter</u> through the back door, but it was locked.**
    (a) come to (b) come in (c) come up (d) come through
18. **He would finish one novel and then <u>continue</u> to the next.**
    (a) go one (b) go out (c) go on (d) go over
19. **Day after day, Raj <u>arrived</u> for class twenty minutes late.**
    (a) show up (b) show out (c) show over (d) show around
20. **The enzyme <u>affects</u> certain proteins.**
    (a) act out (b) act up (c) act as (d) act upon
21. **The police told the protestors to <u>retreat</u>.**
    (a) back out (b) back into (c) back off (d) back up
22. **The next bus should be <u>arriving</u> in the next quarter of an hour or so.**
    (a) be after (b) be along (c) be in for (d) be onto
23. **He grabbed a gun and <u>kills</u> the police office.**
    (a) blow down (b) blow in (c) blow off (d) blow away

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24. The economy is recovering from the recession.
(a) bounce into (b) bounce off (c) bounce in (d) bounce back

25. They didn't mention the subject at the meeting.
(a) bring up (b) bring on (c) bring out (d) bring in

26. The concert had to be cancelled because the singer went down with a bad case of flu.
(a) call off (b) call in (c) call on (d) call out

27. I deliver the things they needed.
(a) drop by (b) drop around (c) drop away (d) drop back

28. This car consumes more petrol.
(a) eat in (b) eat into (c) eat up (d) eat out

29. There are a lot of stories circulating about her past.
(a) fly at (b) fly by (c) fly about (d) fly into

30. He's aging now and doesn't work so hard.
(a) get over (b) get onto (c) get on (d) get through

31. The Prime Minister criticises at her critics in a speech last night.
(a) hit back (b) hit for (c) hit on (d) hit up

32. Rather than go out tonight, we plan to relax and watch television.
(a) kick around (b) kick back (c) kick down (d) kick in

33. I'm going to take rest for a few minutes before we have to go out.
(a) lie about (b) lie back (c) lie in (d) lie down

34. Work just keeps on accumulating and I really can't manage to get it all done.
(a) pile into (b) pile out (c) pile it on (d) pile up

35. Everyone was supporting Ashok to win the Champions League.
(a) root around (b) root for (c) root out (d) root up

36. The antique picture frame just came apart in my hands.
(a) break up (b) break down (c) break away (d) break in

37. It was an important event, and she's managed to bring it off brilliantly.
(a) get behind (b) get through (c) get back (d) get around

38. They were doling out leaflets in front of the station.
(a) hand down (b) hand in (c) hand back (d) hand out

39. The lake dried up because of the water extraction for cotton farming.
(a) die away (b) die for (c) die down (d) die back

40. She eased off the accelerator to let the car slow down.
(a) run away (b) run down (c) run for (d) run into

41. I was ill for a week and fell behind with my work.
(a) hang on (b) hang onto (c) hang back (d) hang out

42. The army attacked the town and the inhabitants fought back fiercely.
(a) beat down (b) beat up (c) beat off (d) beat it

43. I wonder how Sonia is getting on in her new job?
(a) make into (b) make out (c) make of (d) make up

44. Politicians are already gearing up for the election.
(a) fit in (b) fit up (c) fit in with (d) fit out

45. Everything hinges on the result of the negotiations; if they go badly, we'll be in real trouble.
(a) rest on (b) rest up (c) come to rest (d) rest stop

46. There was some financial scandal involving one of the ministers but it was all hushed up.
(a) cover for (b) take cover (c) cover up (d) under cover

47. Once the tourists arrive, the restaurants jack up their prices.
(a) run against (b) run up (c) run off (d) run over

48. I carry a notebook so that I can jot down any ideas.
(a) put down (b) put in (c) put through (d) put out

49. The reigning middleweight champion knocked out the challenger in the fourth round of the fight.
(a) lay down (b) lay aside (c) lay off (d) lay out

50. I've got my exams next week and I haven't done much work, so I'd better knuckle down.
(a) bear down (b) bear on (c) bear out (d) bear up

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51. When Amit found out they were coming for him he lit out for the border.
(a) make out (b) make over (c) make off (d) make of
52. I've been looking for all their hidden files, but I can't find them anywhere.
(a) be in (b) be after (c) be out (d) be up
53. They messed up the discussion and the contract fell though.
(a) screw up (b) screw out of (c) screw around (d) screw it
54. We tried to exclude him of the committee, but he muscled in.
(a) break away (b) break off (c) break out (d) break in
55. We haven't been able to nail down the cause of the fire yet.
(a) pin down (b) pin on (c) pin up (d) pin at
56. I need to polish up my French before I go to Paris.
(a) touch in (b) touch off (c) touch up (d) touch on
57. They went for each other with their fists and had to be pulled apart.
(a) cut back (b) cut up (c) cut in (d) cut out
58. The future of the company now rides on the new managing director.
(a) count against (b) count in (c) count out (d) count on
59. The years rolled by, and I didn't see her again until she was married with two children.
(a) pass as (b) pass by (c) pass on (d) pass around
60. He was rubbed out by the Mafia.
(a) knock off (b) knock out (c) knock up (d) knock back
61. I only learnt Spanish for a year but I can just scrape by in most situations.
(a) bear down on (b) bear on (c) bear up (d) bear out
62. You should see about getting your hair cut.
(a) reckon in (b) reckon up (c) reckon without (d) reckon with
63. The hill had been fenced off to stop animals grazing on it.
(a) shut in (b) shut off (c) shut up (d) shut away
64. We're toying with the idea of going to Paris next year.
(a) muck around (b) muck in (c) muck out (d) muck up
65. I was going to do a parachute jump but I wimped out at the last minute.
(a) take back (b) take away (c) take off (d) take out

2.3 Homonyms

Homonyms (also called homophones) are words that sound like one another but have different meanings. Some homonyms are spelled the same, like bark (the sound a dog makes) and bark (the outer layer of a tree trunk). Below are some commonly used and sometimes confused sets of homonyms as:

Allowed: permitted **Aloud:** out loud; with noise	**Bare:** uncovered, naked **Bear:** endure, support
Board: plank **Bored:** uninterested, tired of something	**Brake:** a device for slowing down a vehicle **Break:** to smash or divide into parts
Capital: the city where the government is located **Capitol:** the building in which the US Congress meets.	**Cent:** a penny **Scent:** a distinctive smell **Sent:** to cause to go
Close: to shut **Clothes:** garments to wear	**Coarse:** rough, crude or harsh **Course:** a path or route to be taken
Die: to pass away **Dye:** colouring	**Fair:** just, proper under the rules, or ample **Fare:** money paid to ride in a public transport
Feat: accomplishment **Feet:** plural of foot	**Hole:** an opening or hollow place **Whole:** the entire amount
Heard: past tense of hear **Herd:** large group of animals	**Hear:** to perceive sounds **Here:** in this place
Heal: to make healthy **Heel:** the back part of the foot **He'll:** he will	**Flew:** past tense of fly **Flu:** short for influenza **Flue:** passage for smoke in a chimney

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Idle: doing nothing **Idol:** a person who is greatly admired	**Loan:** money lent **Lone:** single, only
Mail: items sent in the postal system **Male:** a boy or man	**Main:** most important **Mane:** long hair on the neck of an animal
Meat: edible flesh from an animal **Meet:** get together	**Pail:** bucket **Pale:** lacking colour
Pain: physical distress **Pane:** section of a window	**Passed:** past tense of pass **Past:** later, or in a time gone by
Patience: the ability to wait **Patients:** people under the care of a doctor	**Peace:** absence of war **Piece:** a portion of something
Plain: clear **Plane:** a carpenter's tool, or a flat surface	**Presence:** the state of existing in a place **Presents:** gifts
Stake: a thin pointed stick or post that is driven into the ground **Steak:** a piece of meat or fish	**Rain:** precipitation, drizzle, shower **Reign:** time in power **Rein:** a strap to control an animal
Raise: to build up **Raze:** to tear down	**Road:** driving surface **Rode:** past tense of ride
Sail: travel in a boat **Sale:** a deal or transaction	**Scene:** the place where an event occurs **Seen:** past participle of see
Soar: fly **Sore:** painful	**Sole:** only **Soul:** the spiritual part, or character, of a person
Stair: step **Stare:** to look intently in one place	**Stationary:** unmoving **Stationery:** writing paper
Principal: the leader of a school **Principle:** basic truth or law	**Steal:** to take something without permission **Steel:** a strong metal made of iron and carbon
Tail: the rear part of an animal's body **Tale:** a story	**Waist:** the middle of the body **Waste:** discarded material
To: toward **Too:** also **Two:** a symbol for 1 plus 1	**Threw:** past tense of throw **Through:** movement from one side to, or past, the other side

Example [GA-2016 (1 mark)]: Choose the statement(s) where the underlined word is used correctly:
(i) A prone is a dried plum.
(ii) He was lying prone on the floor.
(iii) People who eat a lot of fat are prone to heart disease.
(a) (i) and (iii) only (b) (iii) only (c) (i) and (ii) only (d) (ii) and (iii) only
Solution (d): A dried plum is a fruit called prune, so statement (i) is not correct.
'Lying prone' means 'lie down flat', so statement (ii) is correct.
'Prone to' means 'vulnerable to', so statement (iii) is correct.
Hence option (d) is correct.

Exercise 2.4

In all the following questions choose the statement where underlined word is used correctly.

1. [GA-2015 (1 mark)]:
(a) When the teacher eludes to different authors, he is being **elusive**.
(b) When the thief keeps eluding the police, he is being **elusive**.
(c) Matters that are difficult to understand, identify or remember are **allusive**.
(d) Mirages can be **allusive**, but a better way to express them in illusory.

2. [GA-2015 (1 mark)]:
(a) The industrialist had a **personnel** jet.
(b) I write my experience in my **personnel** diary.
(c) All **personnel** are being given the day off.
(d) Being religious is a **personnel** aspect.

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3.	**[GA-2015 (1 mark)]:** (a) The minister **insured** the victims that everything would be all right. (b) He **ensured** that the company will not have to bear any loss. (c) The actor got himself **ensured** against any accident. (d) The teacher **ensured** students of good results.
4.	(a) I'll **except** it now that it is certain. (b) At first he thought she would **except** the idea if he gave her the time. (c) I hope you **except** this by the time the baby is born. (d) Nothing was truly resolved **except** possibly the hostility between them.
5.	(a) He watched her lift a **bail** of hay and step up on the pile. (b) In an instant he was beside her, trying to take the **bail** from her hands. (c) She surrendered the **bail** to him and watched him toss it on top of the pile. (d) And now she wants you to **bail** her out?
6.	(a) Of the largest pair in the possession of the Indian Museum, belonged to an elephant killed by **Colonel**. (b) She couldn't help feeling a small **Colonel** of longing deep inside her. (c) The **Colonel** is sound enough though the husk is a poor thing. (d) Muller tried to show that even sense experience throws us on the Infinite - which for him was the **Colonel** of the idea of God.
7.	(a) I needed **council** before I treed that bear at out door. (b) I'm a scientist and if I don't know an answer, I seek **council** from sharper brains. (c) This person needs the **council** of a psychiatrist. (d) Actually, I'm a lawyer, working with local **council** on a pending case.
8.	(a) As he turned down their long drive, he spotted her at the **creak**, on the footbridge. (b) When they stopped beside a wide shallow **creak**, he crouched with his back to her. (c) She didn't walk far before she heard the **creak** and snap of branches. (d) It crossed her mind that he might trip on the mossy rocks, but he crossed the **creak** with sure steps.
9.	(a) I strolled a **discreet** distance from her side as we entered the gardens. (b) There were at another **discreet** location, this one nestled between the peaks of two mountains. (c) A special class of such systems are Hamiltonian flows and their **discreet** analog maps. (d) As the **discreet** breather decays two small traveling waves detach from it and travel away from the central node.
10.	(a) She quickly whipped up pancake **doe** and placed a large iron skillet over the fire with some lard in it. (b) Everything looked normal, so she gave the **doe** her privacy. (c) I'm not sure I can keep the **doe**. (d) Always seemed to have some **doe** but never worked much that I remember.
11.	(a) I asked, more to take his mind off mayhem than to **illicit** information. (b) The Black God had failed to **illicit** anything other than a sneer with every one of his approaches. (c) It is difficult to **illicit** sympathy for a silly old man caught up in dark dealings. (d) Improvements in **illicit** drug use were found both for frequency of use outcomes and for outcomes based upon abstinence from drugs.
12.	(a) The birth of her child was **eminent**, if not past due. (b) There was no luggage standing by to indicate an **eminent** departure. (c) She offered an abbreviated version of Sheela's **eminent** departure. (d) A sweep through the barn failed to reveal any **eminent** births.
13.	(a) I saw funded air **fare** fly out the window. (b) Did I give Jonathan his **fare** share of attention? (c) Still, it wasn't **fare** to put him off on their vacation - especially for two weeks. (d) If he wanted to make it **fare** for the girls, then he should let them run the place.
14.	(a) He sat down on the edge of the bed, staring at his **feat** and then keeled over on the bed.

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	(b) She crawled out of bed, snapping on the light as her stocking **feat** hit the floor. (c) Beyond that, less than three **feat** separated the road from the edge of a cliff. (d) Curious, he twisted to see the door, no easy **feat** given it was on the floor below.
15.	(a) She rocked back and **forth**, tears coursing down her cheeks unchecked. (b) When he came into the house for his **forth** cup of coffee before noon she decided to salvage something from the day. (c) He contended such a visit was in violation of the **forth** amendment of the constitution and tantamount to breaking and entering. (d) After the **forth** week she knew he wouldn't be back.
16.	(a) I think it was **gneiss** of your father to send them. (b) It was going to be **gneiss** having nothing to do but enjoy their little family for the next two weeks. (c) He always looked **gneiss**, but normally he would have worn a suit for the occasion. (d) The church's main points of interest are the three tombs carved in black **gneiss** depicting knights in armour.
17.	(a) The precious **gored** is also the emblem for the figure 8, which holds a lot of power in Feng Shui and Chinese Symbolism. (b) The owner of an ox which **gored** a man on the street was only responsible for damages if the ox was known by him to be vicious, even if it caused death. (c) They said the **gored** of ashes will fall from the air. (d) Looks like we already have a large **gored** on the way, even with two on the vine.
18.	(a) Their daughters were almost **groan** when Carmen was born, but their son was her age. (b) His response was a soft **groan** that vibrated delightfully against her lips. (c) She had **groan** soft in five years of city life. (d) They had **groan** so close.
19.	(a) She dropped to the sand as a **hale** of bullets whistled above her head. (b) Thunder rattled the windowpane and **hale** pounded on the roof. (c) She was to **hale** the offenders to the palace, which implied an efficient and accessible police system. (d) The storm roared in through the ceiling, **hale** and water pelting her body while thunder deafened her.
20.	(a) Damian might have some **incite** into what was going on, and who the Magician was. (b) She alone could provide **incite** into what he needed to do. (c) It will serve only to **incite** more contempt for the law among drivers who are already plagued with oppressive regulations. (d) You have any **incite** into why my power is jacked up?
21.	(a) She **kneed** him in the groin. (b) He didn't **kneed** proof. (c) More than likely his persistence had roots in the **kneed** to dominate her. (d) If you **kneed** anything at all, be sure to let us know.
22.	(a) I know they learned a **lessen** to refrain from touting their operation. (b) These adaptations tend to **lessen** the amount of transpiration by protecting the stomata from the movements of the air. (c) I've found over reaction produces results, a **lessen** from my tip-line experiences. (d) This is the first **lessen** every good spy knows.
23.	(a) If anyone **lynx** me to you, I'm to bury my head and walk away. (b) We are planning to let all **lynx** go to the correct meaning directly, but for now you will have to search it out from the list below by yourself. (c) Their **lynx** with Russian are still strong. (d) The new **lynx** Controller allows the cameraman to operate the remote camera in a traditional style.
24.	(a) The cattle **lowed** from hunger, finding no food on the sun-parched meadows. (b) The Broken Hill **lowed** is the largest yet discovered.

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	(c) At many of the mines at Jharkhand, large quantities of ores of telluride of gold have been found in the **lowed** formations. (d) On the west coast no true **lowed** has yet been discovered, though the vast alluvial deposits of tin found there seem to make such a discovery probable in the future.
25.	(a) The necessity for so many **mince** lay in the imperfect means of communication. (b) The provincial **mince** were all closed just before the reign of Mary, who coined in London only. (c) The report does not **mince** words, describing the situation as ludicrous. (d) The existence of **mince** before the arrival of the Romans.
26.	(a) Every **mussel** in her body was sore. (b) Other species will include coalfish, eels and pouting with peeler crab, **mussel** and lugworm the top baits. (c) Every **mussel** complained so painfully that she wished the numbness would return. (d) A deeper ache, as if she had the flu and every **mussel** in her body was on fire, was made worse by sleeping on the cold floor.
27.	(a) **Nay**, at last his evil destiny pursued him to the battlefield and his own home. (b) With a wild **nay** of terror the animal fell bodily into the pit, drawing the buggy and its occupants after him. (c) So, with a snort and a **nay** and a whisk of his short tail he trotted off the roof into the air and at once began floating downward to the street. (d) The cab-horse was about to reply when suddenly he gave a start and a **nay** of terror and stood trembling like a leaf.
28.	(a) His face looked **pail** and he rode with an alien stiffness. (b) He nodded, his **pail** eyes darkening enough to twinkle. (c) Her eyes were bloodshot but otherwise she looked **pail** lying on the sheets like a limp doll. (d) They all declined, once again, willing to let me carry **pail** up the hill.
29.	(a) A burning **pane** started in her stomach and ended up in her eyes. (b) Would you scratch that on a window **pane** for me? she teased. (c) For a moment she felt the dull aching **pane** of being utterly alone. (d) Realization washed over her in alternating waves of **pane** and numbness.
30.	(a) She made a ball out of a **pare** of socks. (b) **Pare** off any bits of the carrots that don't look very nice. (c) Testing her ankle in a **pare** of low heels, she nodded silent approval and hurried down the hall. (d) Slipping into a **pare** of tennis shoes, she headed for the kitchen.
31.	(a) It also revealed something that gave her **paws** for thought. (b) After a **paws**, his voice was more controlled. (c) He jumped on her again, planting his **paws** on her shoulders. (d) There was a **paws** before she responded.
32.	(a) I wanted a name that would **pique** the curiosity of my perspective audience. (b) His black hair reflected sunlight at the **pique** of every wave. (c) The mountain traffic was at a **pique** with the massive influx of visitors, especially at the lower elevations. (d) Maybe the dream is a good thing, a **pique** at the past?
33.	(a) If that bear came back, Manoj would have to **peal** her off his back. (b) If you try to alert anyone or escape, I'll **peal** your skin from your bodies and watch you scream, Harmony warned. (c) He'd managed to **peal** off his sweater and rinsed the blood off his body in the surf. (d) Brady leaned away only to **peal** off his undershirt.
34.	(a) If stiff muscles didn't let them down, the group would **pedal** into Durango, Colorado, with one leg of the tour behind them. (b) After all, he was a wayward man of the cloth and she did **pedal** her butt for bucks, whatever the extenuating circumstances. (c) In a way it is inevitable, but I never realized that they used blog tools to **pedal** their wares.

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	(d) Some Indian Democrats **pedal** the notion that legislation can eliminate racial and religious discrimination.
35.	(a) I thought as a matter of **principle** you wanted to win in court. (b) Its **principle** function is a secure attachment point for a safety line. (c) We met with the **principle** who looked it all over. (d) Why couldn't you understand that there was a **principle** involved?
36.	(a) Their freight wagons used this **root** to deliver supplies to the tiny town of Delhi. (b) That was why Ashok chose the **root** - less risk of being robbed. (c) Most of the **root** was via Interstate roads and easy driving. (d) He sounded like he was agreeing to a **root** canal.
37.	(a) It was embarrassing when that twinkle came in his eye because he **reed** her torrid thoughts about him. (b) Physically and physiologically wet habitats, with the accompanying plant communities of lakes, **reed** swamps, and marshes. (c) He lifted the paper and started to **reed** again. (d) She watched anxiously as he **reed** her temperature.
38.	(a) Outside of this being her first trip in an airplane, the **wrest** of the flight was uneventful. (b) It was like holding an enemy's sharp two-edged sword by the blade, and that enemy all the time striving to **wrest** it out of your clutch. (c) The **wrest** of the ride was pleasant. (d) Her dark eyes fixed on Carmen, eagerly waiting for the **wrest** of the story.
39.	(a) She was dressed much more normally than Ingrid in dark jeans and a simple, fitted blue t-shirt with bright **choral** nail polish. (b) The **choral** fishery - mainly on the west coast - has lost its former importance. (c) **Choral** writing itself has become different from what it was in the 16th century. (d) It is surrounded by **choral** reefs, and is richly wooded.
40.	(a) Ashok snickered and Mohan glanced up in time to see Radha **chute** his mother a warning look. (b) Come on, don't **chute** it down before you give it a try. (c) Whether they are loaded by shovel or by gravity from a **chute**. (d) Do you ever **chute** any wolves?
41.	(a) Slice the **roe** and slowly braise for half an hour in the mixture, adding the pimento. (b) We had two runaways in a **roe** followed by a location Howie. (c) He was at a **roe** machine, covered in sweat. (d) I am physically satisfied for the fifth day in a **roe**, for the first time since I was hatched.
42.	(a) He sat as the dream faded and patted the necklace with the dangling sun-star **cymbal** marking his demigod status. (b) She touched it, as thrilled to wear his **cymbal** as she had been her father's. (c) His eyes went to the **cymbal** at her neck, and one eyebrow shot up. (d) At some point my flying hand hits **cymbal** bruising wrist which soon swells.
43.	(a) It didn't take more than a few hours of sun for the **dessert** to become an inferno. (b) The money she earned from each of the trips across the **dessert** was devoted entirely to paying off the loan. (c) How many people **dessert** from the army each year? (d) She wasn't sure why he'd care if she ate or took her **dessert** home.
44.	(a) Alexia had arrived long before her **dew** date. (b) Epiphytic plants have absorptive hairs or scales on the leaf epidermis through which rain and **dew** can be absorbed. (c) She was **dew** to foal in July. (d) All this attention from Howard could be **dew** to a guilty conscience.
45.	(a) Alex patiently consoled and distracted her while the nurse taped a padded **bored** to her hand and wrist so she couldn't move it.

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	(b) His gaze **bored** into hers, immediately identifying the source of her apprehension. (c) After tomorrow, it's back to the drawing **bored**. (d) Yes, we were as frightened as a kid on a high **bored**, looking at the water below.
46.	(a) The suitcase didn't **seam** that heavy at the time. (b) He didn't **seam** to notice anything unusual in his attitude, so maybe he had always treated them that way. (c) Megan stepped forward and the heel of her sandal sank into a **seam** in the walkway. (d) Christmas was only a few days away, and yet it didn't **seam** like Christmas.
47.	(a) Then came a cart, and behind that walked an old, bandy- legged domestic **surf** in a peaked cap and sheepskin coat. (b) Ashok knew that this Manmohan, disdainful of everybody and who considered himself above them, was all the same his **surf** and huntsman. (c) He yelled her name but the call was smothered by the cry of the wind and the crash of the **surf** beyond. (d) Two young citizens were joking with some **surf** girls who were cracking nuts.
48.	(a) The smile was replaced by a **serge** of color as he jerked the barn door open. (b) His body responded with a **serge** of desire he gritted his teeth against. (c) As the weather became warmer the thin **serge** suit was much appreciated. (d) His body responded with a **serge** of heat and desire at the idea of feeling her naked body beneath his.
49.	(a) They wrestled, fed and fucked until **shear** exhaustion overtook her, and she slid into a short doze. (b) The tears returned, from **shear** frustration. (c) The **shear** lust in them left her wishing he had looked elsewhere. (d) She was silent, a look of **shear** panic on her face.
50.	(a) How could any human be so heartless to **sleigh** an infant? (b) She was on a huge, plush **sleigh** bed with dark wood and pastel coverings. (c) He did not **sleigh** the Dark One. (d) Hey, **sleigh** the balance.
51.	(a) I was miffed that I was the **sole** person burdened with straightening out this mess. (b) Now he understood the term, **sole** mate. (c) I knew because he proved to me that I could trust him with my heart and **sole** - the way you trust your mother and father. (d) It wasn't important who they inherited their traits from, but it was a brief look at the **sole** of this mysterious woman no one seemed to understand.
52.	(a) That's a long way to drive for **stake** and potatoes. (b) The penalty for stealing the Host was the **stake**; that for other crimes was graded accordingly. (c) Just because my conscious mind doesn't remember doesn't mean my subconscious didn't dredge it up with the **stake** and onions we had for dinner. (d) Brady grunted in response and dug into the **stake** on the plate before him.
53.	(a) His **swayed** pants clung to long, thick thighs and were tucked into heavy boots. (b) He went through one of Andre's two walk-in closets, choosing a maroon sweater and chocolate **swayed** pants. (c) The walls were covered in **swayed**, she realized as she placed a hand against one. (d) His shoulders **swayed** gracefully, the open denim jacket swinging loosely in the breeze.
54.	(a) In spite of the fact that you're as nutty as a full course **sundae**, you're a nice guy. (b) As she was dressing for church one **sundae**, she was having zipping up her dress. (c) **sundae** dawned a sunny hot July day. (d) He's only here until **sundae** night when we drop him off in Delhi for his flight back to the Mumbai.
55.	(a) The **teem** was harnessed and ready to go. (b) Apparently scrounging food off the desert wasn't nearly as easy as harnessing a **teem** of mules.

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	(c) He stepped away from the **teem** as she walked approached and she glared at him. (d) The sagas **teem** with references to the inhabitants of the fairy mounds, who play such an important part in the mind of the peasantry of our own time.
56.	(a) She read the words **aloud** and he snorted. (b) He began suckling in a way that **aloud** air to enter around his mouth. (c) Again she had **aloud** herself to be put in a precarious situation. (d) You're not **aloud** to take as much as a plant from it.
57.	(a) He ran two fingers along a **vane** in her neck then kissed it. (b) There was also a beautiful pyramidal structure, surmounted by the **vane** to indicate the direction of the wind. (c) He fumbled or a moment, but failed to find a **vane** with her gripping his throat. (d) She ran her fingers up his arm, tracing the large **vane** – feeling the fine dark hair.
58.	(a) Here, some light **vile** the living room picture window provided a faint outline of fixtures and furniture. (b) She wrapped her hand around the **vile** and focused on calling a portal back to her room. (c) She gave a hint of a nod, remaining under the archway to the parlour, as if entering might subject her to some **vile** disease from these common folk. (d) Deidre twisted the top of the **vile** open and neared the girl.
59.	(a) In a **whey** he dreaded telling her the news - seeing that painful indecision in her eyes. (b) Proteins supply these amino acids to the muscles which is why athletes use **whey** protein. (c) Step by step she was working her **whey** through this, not actually making a decision. (d) This time her hands felt their **whey** up his smooth muscular chest - up to his shoulders and then up the back of his neck.
60.	(a) The **wine** in her voice made him cringe. (b) On the other side of the thick entry door was a sitting room with lush **wine** coloured carpet. (c) The **wine** of a straggling hound could be heard. (d) The only sound was a barely audible **wine** from the turbo.
61.	(a) She felt him assess her before he pried her hand free and rested his there, **ceiling** the wound. (b) Reaching inside the door, he flipped the light switch and the room was flooded with light from a **sealing** fan. (c) **Ceiling** the letter, she took a stamp from her purse and placed it on the envelope. (d) The sound of the door closing sounded like the **sealing** of her fate.
62.	(a) Her pain was raw, yet there was **mettle** in her backbone if she'd gone to Sean's funeral, fully knowing her own father killed the Guardian. (b) But Jade was like most immortals: he'd only ever loved other men, whereas Kris valued **metal** over sex. (c) As the path turned, the broad side of a **mettle** building came into view, nestled at the foot of a cliff. (d) She didn't have the **mettle** to survive the way he knew how.
63.	(a) The size of a small dinner plate which when filled with local boiled ham or cheese, the **feint** hearted must avert the gaze. (b) The light causes the pupils to contract thereby making the **faint** stars impossible to see. (c) A **feint** smile was on his lips and in his eyes. (d) Looking at this image of the Document Window you should be able to see **faint** outlines of Hot Spots.
64.	(a) Lori nodded **assent** and Alex set out to determine if anything needed to be done before they left. (b) He turned and without hesitation, began the short **assent** to the mine without even inquiring about directions. (c) She murmured an **ascent** and ended the conversation. (d) He nodded his **ascent** and she continued.
65.	(a) She rubbed a **soar** spot in her lower back. (b) Even so, it left a large bruise and **sore** ribs for a few weeks. (c) She would have a **soar** neck if she stayed that way for long.

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	(d) They steal and **sore** then alight on rooftops in the breeze.
66.	(a) You should keep the fractured finger **stationery** for one week. (b) The lawyer wrote the letter on her business **stationary**. (c) If there's a **stationary** point you could tie on to. (d) **Stationery** scouts shifted only when necessary.
67.	(a) She finished pealing the potato and **through** it into the pan before continuing. (b) As he walked **threw** the lobby, he spoke to the receptionist. (c) Step by step she was working her way **threw** this, not actually making a decision. (d) His warm hands slid under her jacket, caressing her back **through** the thin T-shirt.
68.	(a) We shared our sadness at the **waste** of two barely emerging lives with the remainder of the celebratory bourbon. (b) The belt was too large for her small **waste**. (c) Then don't **waist** any more of my time. (d) It's not science and it's a **waist** of time but what the hell; it's a rainy afternoon, with nothing else going on.

2.4 One Word Substitution

'One Word Substitutes' are the words that replace group of words or a full sentence effectively without creating any kind of ambiguity. Some of the common One Word Substitutes are given as:

Phrase or Sentence		One Word Substitute
A place where animals are killed for their meat	:	Abattoir
A person who help someone else to do something morally wrong	:	Accomplice
A person who understand and enjoy beauty	:	Aesthete
Having lot of money or owing a lot of things	:	Affluent
Fear of open spaces	:	Agoraphobia
To make something bad such as pain or problem less severe	:	Alleviate
Willing to do things which benefit other people	:	Altruist
A thing which exists out of its time in history	:	Anachronism
An agreement to stop fighting in a war	:	Armistice
A class of people who hold high social rank	:	Aristocracy
A skilled entertainer especially a dancer, singer or actor	:	Artiste
Someone who believes that God or gods do not exist	:	Atheist
A government where the power is concentrated in the hands of one person	:	Autocracy
Wishing to fight or argue	:	Belligerent
One who is irrelevant towards God	:	Blasphemous
Using only a few words or lasting only a short time	:	Brevity
A company that makes beer or a place where beer is made	:	Brewery
Beautiful writing often created with a special pen or brush	:	Calligraphy
Not having sexual activity because of making a religious promise to do this	:	Celibacy
A person who pretends to have skills or knowledge that they do not have	:	Charlatan
To change from liquid to a more solid state	:	Coagulate
Informal and more suitable for use in speech than in writing	:	Colloquial
Able to burn easily	:	Combustible
A person who comes from the same country	:	Compatriot
A person who is competent to pass critical judgement upon anything	:	Connoisseur
To force someone by law to serve in one of the armed forces	:	Conscript
An organisation of several businesses	:	Consortium
A small argument or unlucky event, often happening in public	:	Contretemps
Something to be corrected in a printed book	:	Corrigendum
A journey on a large for pleasure, during which you visit several places	:	Cruise

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Phrase or Sentence		One Word Substitute
A young swan (large white bird with a long neck)	:	Cygnet
One who has little faith in human sincerity or honesty	:	Cynic
A complete failure because of bad planning and organisation	:	Debacle
A person who can sway his followers by his oratory	:	Demagogue
The end result of a situation	:	Denouement
Someone who willingly does risky, dangerous and often criminal things	:	Desperado
Something to discourage people from doing wrong	:	Deterrent
Careful and using a lot of effort	:	Diligent
Reduction of weapons by government	:	Disarmament
A series of actions taken by the police which are intended to catch criminals	:	Dragnet
Hard boring work	:	Drudgery
A song or other piece of music sung or played by two people	:	Duet
Very energetic, positive and happy	:	Ebullient
Describes a man who behaves or look similar to a women	:	Effeminate
To kill someone by causing electricity to flow through their body	:	Electrocute
An order to temporarily stop something, especially trading or giving information	:	Embargo
To use chemicals to prevent a dead body from decaying	:	Embalm
A disease confined to a particular district or place	:	Endemic
Something that is mysterious and seems impossible to understand completely	:	Enigma
The scientific study of insects	:	Entomology
Lasting for only a short time	:	Ephemeral
A brief summary of a book	:	Epitome
The study of the efficiency of people in their working environment	:	Ergonomics
The wide part of a river at the place where it joins the sea	:	Estuary
Done or said without advance preparation or thought	:	Extempore
To kill all the animals or people in a particular place or of a particular type	:	Exterminate
An energetic happy person who enjoys being with other people	:	Extrovert
Strong and going quickly	:	Exuberant
An idea that a lot of people think is true but which is false	:	Fallacy
A person filled with excessive enthusiasm, especially in religion	:	Fanatic
A humorous play where the characters become involved in unlikely situations	:	Farce
Having a strong dislike of anything dirty or unpleasant	:	Fastidious
Extremely active or too excited	:	Febrile
To beat someone very hard with a stick, as a punishment	:	Flog
Of, found in, or produced by rivers	:	Fluvial
Paper of standard size, measuring 17.2 × 21.6 centimetres	:	Foolscap
The crime of murdering your brother	:	Fratricide
Goods carried from one place to another by ship or train or truck, etc.	:	Freight
A person who is running away or hiding from the police or a dangerous situation	:	Fugitive
To use poisonous gas to remove harmful insects from somewhere	:	Fumigate
A group of soldiers living in or defeating a town or building	:	Garrison
Having the habit of talking a lot, especially about unimportant things	:	Garrulous
The art of knowledge involved in preparing and eating good food	:	Gastronomy
Killing whole group of peoples belongs to nation or race or religion	:	Genocide
A supply of something that is much greater than can be sold or needed	:	Glut
Rough drawing or writing on public walls	:	Graffiti
Without payment or free of cost	:	Gratis
Very emotional and energetic, but lacking sincerity or real meaning	:	Histrionic
A very large amount of destruction, especially by fire or heat	:	Holocaust

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Phrase or Sentence		One Word Substitute
A leather holder for a pistol	:	Holster
Killing of one man by another man	:	Homicide
A position in an organisation for which no payment is made	:	Honorary
A person who act in a violent way without thinking and causes damage	:	Hooligan
The central part of something where there is most activity	:	Hub
One who has exaggerated anxiety about his health	:	Hypochondriac
Exaggerated statement made for the sake of effect	:	Hyperbole
A written sign or symbol used in some writing systems	:	Ideogram
Designed to cause fire	:	Incendiary
A person who knows nothing	:	Ignoramus
Too old to be remembered, ancient beyond memory	:	Immemorial
Coming or likely to be happen very soon	:	Imminent
Living or lasting forever	:	Immortal
Describes strong opinions or feelings which are impossible to change	:	Implacable
Showing signs that something will not be successful or positive	:	Inauspicious
Not having a physical body but a spiritual form	:	Incorporeal
Impossible or very difficult to believe	:	Incredible
Describes a mark or substance that is impossible to remove by washing	:	Indelible
Naturally existing in a place or country rather than arriving from another place	:	Indigenous
Something which cannot be eaten	:	Inedible
Certain to happen or unable to be avoided or prevented	:	Inevitable
Unable to be explained or understood	:	Inexplicable
To cause to increase in size by filling with air	:	Inflate
A person who is very clever and skilful	:	Ingenious
Very unusual or of very high quality and therefore impossible to copy	:	Inimitable
An ability that which one is born with	:	Innate
Completely harmless	:	Innocuous
A feeling or quality that exists but you cannot describe it exactly or prove it	:	Intangible
Examination and consideration of your own ideas thoughts and feelings	:	Introspection
Ability to understand something immediately without needing to think about it	:	Intuition
Impossible to defeat or prevent from doing what is intended	:	Invincible
Impossible to damage or hurt in any way	:	Invulnerable
Very unusual or of very high quality and therefore impossible to copy	:	Inimitable
Fighting between members of same group, religion or country	:	Internecine
To walk across a road at a place where it is not allowed	:	Jaywalk
To put things which are not similar next to each other	:	Juxtapose
A long loose piece of outer clothing with very wide sleeves	:	Kimono
One who behaves like a servant by always obeying	:	Lackey
Using very few words to express hat you means	:	Laconic
A material which is made by sticking several layers of the same material together	:	Laminate
Describes writing or print that can be read easily	:	Legible
Of or like a lion	:	Leonine
The activity or job of writing dictionaries	:	Lexicography
One who believes that one should have freedom of expression	:	Libertarian
A humorous poem with five lines	:	Limerick
The study of lakes and other fresh water bodies	:	Limnology
People with good education who know a lot about literature	:	Literati
Describes someone who talks a lot	:	Loquacious
Not complicated or demanding much intelligence to be understood	:	Lowbrow
A quiet song which is sung to children to help them go to sleep	:	Lullaby

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Phrase or Sentence		One Word Substitute
Unscrupulous in gaining what is wanted	:	Machiavellian
A large knife with a wide blade, used for cutting trees and plants	:	Machete
A strict disciplinarian	:	Martinet
A person animal or object which is believed to bring good luck	:	Mascot
A building in which the bodies of dead people are buried	:	Mausoleum
One who is neither intelligent nor dull	:	Mediocre
An unnaturally great desire for power and control	:	Megalomania
Very pleasant to listen to	:	Melodious
Related to trade or business	:	Mercantile
Very careful and with great attention to every detail	:	Meticulous
Someone who dislike other people and avoids involvement with society	:	Misanthrope
A man who hates women or believes that men are much better than women	:	Misogynist
A long speech by one person	:	Monologue
When someone is too interested in one thing	:	Monomaniac
The belief that there is only one god	:	Monotheism
The scientific study of fungi	:	Mycology
When you feel as if you are going to vomit	:	Nausea
Downfall that satisfies natural justice	:	Nemesis
A job or person which is very suitable for someone	:	Niche
A new word or expression	:	Neologism
Special favour shown by a person in high position to his relatives	:	Nepotism
The study of collecting coins, bank notes and medals	:	Numismatics
Notice of person's death in newspaper	:	Obituary
Not is use any more, having been replaced by something newer and better	:	Obsolete
Having unlimited power	:	Omnipotent
Having or seeming to have unlimited knowledge	:	Omniscient
Someone who always believes that good things will happen	:	Optimist
An area of land where fruit trees are grown	:	Orchard
The study of birds	:	Ornithology
To avoid someone intentionally from taking part in the activities of a group	:	Ostracize
The belief that war is wrong, and therefore that to fight in a war is wrong	:	Pacifism
A remedy which can cure all diseases	:	Panacea
Contradictory statements	:	Paradox
A person who is not accepted by a social group	:	Pariah
A fat stomach, especially on man	:	Paunch
A person who is too interested in formal rules and small unimportant details	:	Pedant
Second from the last	:	Penultimate
Person who refuses to see the beauty or the value of art or culture in any form	:	Philistine
The study of the sounds made by the human voice	:	Phonetics
Someone who makes a legal complaint against someone else in court	:	Plaintiff
A relationship or emotion that is very close but not sexual	:	Platonic
Belonging to a low social class	:	Plebeian
Government by the wealthy people	:	Plutocracy
The fact or custom of being married to more than one person at the same time	:	Polygamy
One who speaks many languages	:	Polyglot
Happening after a person's death	:	Posthumous
One who uses common sense	:	Pragmatist
Knowing or suggesting correctly what will happen in the future	:	Prescient
An important supporter of an idea or political system	:	Protagonist
A pen-name assumed by a writer	:	Pseudonym

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Phrase or Sentence		One Word Substitute
To make the usual sound of a duck	:	Quack
Having or showing ideas that are imaginative bit not practical	:	Quixotic
Someone who tells amusing or interesting stories	:	Raconteur
A good understanding of someone and an ability to communicate well with them	:	Rapport
Willing to listen to and accept new ideas and suggestions	:	Receptive
To make something stronger	:	Reinforce
A new growth of activity or interest in something, especially art, literature, etc.	:	Renaissance
An official demand or request	:	Requisition
Deserved and severe punishment	:	Retribution
The leader of a group of people who are doing something harmful or illegal	:	Ringleader
Any of various small mammals with large sharp front teeth, such as mice	:	Rodent
Wanton destruction of a plant by workmen	:	Sabotage
Treating someone holy or important without respect	:	Sacrilege
A place for invalids and convalescents	:	Sanatorium
Acting as if morally better than others	:	Sanctimonious
A structure on which criminals used to be hanged	:	Scaffold
A person who doubts the truth or value of an idea or belief	:	Sceptic
Involving little exercise or physical activity	:	Sedentary
A person who claims to be able to say what will happen in the future	:	Seer
The intentional producing of excitement or shock	:	Sensationalism
A dark shape seen against a light background	:	Silhouette
A position which involves little work, but for which the person is paid	:	Sinecure
A small and often interesting piece of news, information or conversation	:	Snippet
A short period when a person stays in a particular place	:	Sojourn
Something which is not fresh	:	Stale
A sudden rush of large number of frightened people or animals	:	Stampede
One who is indifferent to pain and pleasure	:	Stoic
A trick to deceive an enemy	:	Stratagem
Having a very severe effect or being extremely limiting	:	Stringent
Existing under the sin	:	Subcutaneous
Old and almost no longer suitable for work or use	:	Superannuated
More than is needed or wanted	:	Superfluous
Strange, not like reality, like a dream	:	Surreal
Collection of views of several persons on a topic	:	Symposium
An action avoided for religious or social reasons	:	Taboo
The art of stuffing animals and setting them in life-like poses	:	Taxidermy
A country that is ruled by religious leaders	:	Theocracy
A type of dictionary in which words with similar meanings are grouped together	:	Thesaurus
The art of cutting bushes into attractive shapes, especially of animals and birds	:	Topiary
A ruler with complete power who rules cruelty	:	Tyrant
A tradesman who manages funerals	:	Undertaker
Intended for use by both males and females	:	Unisex
Ideally perfect but impracticable	:	Utopian
One who wanders without settled home	:	Vagabond
Using exactly the same words as were originally used	:	Verbatim
Of many sided ability	:	Versatile
Done for another	:	Vicarious
A place for breeding or preserving rabbits	:	Warren
To blow the chaff from grain before it can be used as food	:	Winnow
Extreme and showing complete lack of care	:	Wanton
Extreme dislike or fear of foreigners, their customs, their religions, etc.	:	Xenophobia

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Now, let us consider some examples regarding One Word Substitution. In all the following questions choose the most suitable one word, from the given four options, substitute for the following expression:

Example [GA-2015 (1 mark)]: Connotation of a road or way
(a) Pertinacious (b) Viaticum (c) Clandestine (d) Ravenous
Solution (a): Connotation means 'a feeling or idea that is suggested by a particular word although it is not necessarily a part of the word's meaning, or something suggested by an object or situation'. So the most relevant option for 'Connotation of a road or way' is option (a), i.e., Pertinacious, which means 'very determined and refusing to be defeated by problems'.

Example [GA-2015 (1 mark)]: A generic term that includes various items of clothing such as a skirt, a pair of trousers and a shirt is
(a) Fabric (b) Textile (c) Fibre (d) Apparel
Solution (d): Apparel means 'clothes of particular type when they are being sold in a shop'. So, option (d) is correct.

Example [GA-2016 (1 mark)]: A rewording of something written or spoken is a _____.
(a) paraphrase (b) paradox (c) paradigm (d) paraffin
Solution (a): Paraphrase means 'to repeat something written or spoken using different words'.
Paradox means 'a situation or statement which seems impossible or is difficult to understand because it contains two opposite facts or characteristics'.
Paradigm means 'a model of something, or a very clear and typical example of something'.
Paraffin means 'a clear liquid with a strong smell made from coal or petroleum and used as a fuel, especially in heaters and lights'.
Hence option (a) is correct.

Exercise 2.5

Choose one from the given four options which the most suitable 'one word substitute' for the given expression.

1. **Extreme old age when a man behaves like a fool**
   (a) Imbecility (b) Senility (c) Dotage (d) Superannuation
2. **State in which the few govern the many**
   (a) Monarchy (b) Oligarchy (c) Plutocracy (d) Autocracy
3. **A person who knows many foreign languages**
   (a) Linguist (b) Grammarian (c) Polyglot (d) Bilingual
4. **The custom or practice of having more than one husband at same time**
   (a) Polygyny (b) Polyphony (c) Polyandry (d) Polychrome
5. **One who is not easily pleased by anything**
   (a) Maiden (b) Mediaeval (c) Precarious (d) Fastidious
6. **Habitually silent or talking little**
   (a) Servile (b) Unequivocal (c) Taciturn (d) Synoptic
7. **A child born after death of his father**
   (a) Posthumous (b) Orphan (c) Bastard (d) Progenitor
8. **A disease of mind causing an uncontrollable desire to steal**
   (a) Schizophrenia (b) Claustrophobia (c) Kleptomania (d) Megalomaniac
9. **Detailed plan to journey**
   (a) Travelogue (b) Travel-kit (c) Schedule (d) Itinerary
10. **Incapable of being seen through**
    (a) Ductile (b) Opaque (c) Obsolete (d) Potable
11. **One who is determined to exact full vengeance for wrong done to him**
    (a) Virulent (b) Vindictive (c) Usurer (d) Vindicator
12. **Murder of a king**
    (a) Infanticide (b) Matricide (c) Genocide (d) Regicide

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13. One absorbed in his own thoughts and feelings rather than in things outside
(a) Scholar (b) Recluse (c) Introvert (d) Intellectual
14. That which is perceptual by touch is
(a) Contagious (b) Contingent (c) Tenacious (d) Tangible
15. Having superior or intellectual interests and tastes
(a) Elite (b) Highbrow (c) Sophisticated (d) Fastidious
16. A light sailing boat built specially for racing
(a) Canoe (b) Yacht (c) Frigate (d) Dinghy
17. Of outstanding significance
(a) Monumental (b) Rational (c) Ominous (d) Evident
18. Code of diplomatic etiquette and precedence
(a) Statesmanship (b) Formalism (c) Hierarchy (d) Protocol
19. That which cannot be believed
(a) Incredible (b) Incredulous (c) Implausible (d) Unreliable
20. To issue a thunderous verbal attack
(a) Languish (b) Animate (c) Fulminate (d) Invigorate
21. A religious discourse
(a) Preach (b) Stanza (c) Sanctorum (d) Sermon
22. A person who insists on something
(a) Disciplinarian (b) Sticker (c) Instantaneous (d) Boaster
23. Official misconduct
(a) Maleficence (b) Malfeasance (c) Maltreatment (d) Maladministration
24. A person who renounces the world and practices self-discipline in order to attain salvation
(a) Antiquarian (b) Ascetic (c) Sceptic (d) Devotee
25. A disease or accident which ends in death
(a) Fatal (b) Drawn (c) Fastidious (d) Illegal
26. One who does a thing for pleasure and not as profession
(a) Philanderer (b) Amateur (c) Empirical (d) Imposter
27. An animal that is equally at home on land and in water
(a) Domestic (b) Abstemious (c) Amphibious (d) Cannibal
28. A general pardon granted by the government to political offenders
(a) Amnesty (b) Alimony (c) Diplomacy (d) Armistice
29. A person who readily believes others
(a) Creditable (b) Credulous (c) Credible (d) Sensitive
30. Process of thoughts
(a) Commiseration (b) Cerebration (c) Insinuation (d) Machination
31. Having no beginning or end to its existence
(a) Eternal (b) Obscure (c) Ambiguous (d) Arcane
32. A person who is against the standards of ordinary society especially in dressing
(a) Joker (b) Hippy (c) Scapegoat (d) Butt
33. An animal story with a moral
(a) Fable (b) Tale (c) Anecdote (d) Parable
34. A person of infirm body or sticky constitution
(a) Vandalism (b) Valetudinarian (c) Versatile (d) Verbose
35. An irrational fear of death
(a) Thanatophobia (b) Hydrophobia (c) Cynophobia (d) Egomania
36. A person who is always looking for a fight
(a) Bellicose (b) Chivalrous (c) Patriot (d) Bigot
37. A person who is generous and exalted soul
(a) Magnanimous (b) Miser (c) Stingy (d) Frugal
38. A person who is very formal in etiquette
(a) Genius (b) Literate (c) Punctilious (d) Obdurate
39. A person who is jovial and fond of festivals
(a) Sceptic (b) Nihilist (c) Convivialist (d) Philatelist
40. Intended for vain display, showy

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(a) Extrovert (b) Ostentatious (c) Opaque (d) Bathos

41. That which is clear
(a) Ambiguous (b) Dexterity (c) Unambiguous (d) Monism

42. A child that is developed or matured before time
(a) Precocious (b) Pseudonym (c) Soliloquy (d) Caesarean

43. The crime for literary theft
(a) Plagiarism (b) Pluralism (c) Partiality (d) Panacea

44. The act of violating an oath of solemn promise
(a) Philanderer (b) Sojourn (c) Perjury (d) Paroxysm

45. One favouring the policy of peace
(a) Pacifist (b) Aggressionist (c) Imperialists (d) Heretic

46. A victory gained at too great an expense
(a) Pyrrhic (b) Decisive (c) Bloody (d) Celibacy

47. A disease peculiar to a country
(a) Epidemic (b) Contagious (c) Endemic (d) Infection

48. Gift left by will
(a) Alimony (b) Parsimony (c) Legacy (d) Property

49. Paying back injury with injury
(a) Vendetta (b) Repression (c) Subjugation (d) Reprisal

50. Witty, clever retort
(a) Sarcasm (b) Repartee (c) Platitude (d) Invective

51. Relationship by blood or birth
(a) Parentage (b) Affiliation (c) Consanguinity (d) Nepotism

52. Walking in sleep
(a) Somniloquism (b) Somnambulism (c) Obsession (d) Hallucination

53. A sudden rush of wind
(a) Gale (b) Typhoon (c) Gust (d) Stoma

54. Constant effort to achieve something
(a) Perseverance (b) Attempt (c) Enthusiasm (d) Vigour

55. To take one to task
(a) Disgrace (b) Handle (c) Entreat (d) Rebuke

56. One desirous of getting money
(a) Avaricious (b) Voracious (c) Garrulous (d) Greedy

57. Deriving pleasure from inflicting pain on others
(a) Sadism (b) Malevolence (c) Bigotry (d) Masochism

58. Atonement for one's sins
(a) Redemption (b) Repentance (c) Salvation (d) Expiation

59. Plain or self-evident truth
(a) Proverb (b) Precept (c) Truism (d) Formula

60. A story in verse
(a) Elegy (b) Hymn (c) Sonnet (d) Ballad

61. A person who lives by himself
(a) Venerable (b) Sage (c) Quietus (d) Recluse

62. A short walk for pleasure or exercise
(a) Jog (b) Stroll (c) Gallop (d) Promenade

63. Ridiculous use of words
(a) Onomatopoeia (b) Malapropism (c) Neologism (d) Pun

64. The normal abode of any animal or plant
(a) Environment (b) Habitat (c) Settlement (d) Niche

65. Of outstanding significance
(a) Meaningful (b) Ominous (c) Evident (d) Monumental

2.5 Fill in the Blanks

Example [GA-2016 (1 mark)]: Despite the new medicine's _____ in treating diabetes, it is not _____ widely.

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(a) effectiveness --- prescribed (b) availability --- used
(c) prescription --- available (d) acceptance --- proscribed
Solution (a): 'Effectiveness' is noun and 'prescribed' is verb. These words are suitable and befitting with the word 'medicine'. So option (a) is correct.

Example [GA-2016 (1 mark)]: The students _____ the teacher on teachers' day for twenty years of dedicated teaching.
(a) facilitated (b) felicitated (c) fantasized (d) facillitated
Solution (b): Facilitate means 'to make possible or easier'; Felicitate means 'honour'; Fantasise means 'to think about something very pleasant that is unlikely to happen'; Facillitate is not any word. Hence option (b) is correct.

Example [GA-2016 (1 mark)]: Archimedes said, "Give me a lever long enough and a fulcrum on which to place it, and I will move the world." The sentence above is an example of a _____ statement.
(a) figurative (b) collateral (c) literal (d) figurine
Solution (a): Figurative means 'words and phrases used not with their basic meaning but with a more imaginative meaning'.
Collateral means 'valuable property owned by someone who wants to borrow money which they agree will become the property of the company or person who lends the money if the debt is not paid back'.
Literal means 'the literal meaning of a word is its original, basic meaning'.
Figurine means 'a small model of a human, usually made of clay'.
Hence the statement said by Archimedes is a figurative statement. So option (a) is correct.

Exercise: 2.6

In each of the following questions choose the most appropriate word from the options given below to complete the following sentence:

1. **[GA-2010 (1 mark)]:** If we manage to _____ our natural resources, we would leave a better planet for our children.
   (a) uphold (b) restrain (c) cherish Conserve
2. **[GA-2010 (1 mark)]:** His rather casual remarks on politics _____ his lack of seriousness about the subject.
   (a) masked (b) belied (c) betrayed (d) suppressed
3. **[GA-2010 (1 mark)]:** The committee wrote a _____ report, extolling only the strengths of the proposal.
   (a) reasonable (b) supportive (c) biased (d) fragmented
4. **[GA-2010 (1 mark)]:** If the country has to achieve real prosperity, it is _____ that the fruits of progress reach all, and in equal measure.
   (a) inevitable (b) contingent (c) oblivious (d) imperative
5. **[GA-2010 (1 mark)]:** The two child norm with _____ for the violators will have significant implications for our demographic profile.
   (a) disincentives (b) incitements (c) restrictions (d) restraints
6. **[GA-2010 (1 mark)]:** There is no fixed relation between food and famine; famines can occur with or without substantial _____ in food output.
   (a) aberration (b) weakening (c) decline (d) deterioration
7. **[GA-2011 (1 mark)]:** We lost confidence in him because he never _____ the grandiose promises he had made.
   (a) delivered (b) delivered on (c) forgot (d) reneged on
8. **[GA-2011 (1 mark)]:** The _____ of evidence was on the side of the plaintiff since all but one witness testified that his story was correct.
   (a) paucity (b) propensity (c) preponderance (d) accuracy

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9. **[GA-2011 (1 mark)]:** Under ethical guidelines recently adopted by the Indian Medical Association, human genes are to be manipulated only to correct diseases for which _____ treatments are unsatisfactory.
(a) similar (b) most (c) uncommon (d) available
10. **[GA-2011 (1 mark)]:** It was her view that the country's problems had been _____ by foreign technocrats, so that to invite them to come back would be counter-productive.
(a) identified (b) ascertained (c) exacerbated (d) analysed
11. **[GA-2011 (1 mark)]:** If you are trying to make a strong impression on your audience, you cannot do so by being understated, tentative or _____.
(a) hyperbolic (b) restrained (c) argumentative (d) indifferent
12. **[GA-2011 (1 mark)]:** Despite the mixture's _____ nature, we found that by lowering its temperature in the laboratory we could dramatically reduce its tendency to vaporize.
(a) acerbic (b) resilient (c) volatile (d) heterogeneous
13. **[GA-2011 (1 mark)]:** Because she had a reputation for _____ we were surprised and pleased when she greeted us so _____.
(a) insolence…irately (b) insouciance…curtly
(c) graciousness…amiably (d) querulousness…affably
14. **[GA-2012 (1 mark)]:** The administrators went on to implement yet another unreasonable measure, arguing that the measures were already _____ and one more would hardly make a difference.
(a) reflective (b) utopian (c) luxuriant (d) unpopular
15. **[GA-2012 (1 mark)]:** To those of us who had always thought him timid, his _____ came as a surprise.
(a) intrepidity (b) inevitability (c) inability (d) inertness
16. **[GA-2012 (1 mark)]:** The high level of _____ of the questions in the test was _____ by an increase in the period of time allotted for answering them.
(a) difficulty…compensated (b) exactitude…magnified
(c) aptitude…decreased (d) attitude, mitigated
17. **[GA-2012 (1 mark)]:** Despite several _____ the mission succeeded in its attempt to resolve the conflict.
(a) attempts (b) setbacks (c) meetings (d) delegations
18. **[GA-2012 (1 mark)]:** Given the seriousness of the situation that he had to face, his _____ was impressive.
(a) beggary (b) nomenclature (c) jealousy (d) nonchalance
19. **[GA-2013 (1 mark)]:** Friendship, no matter how _____ it is, has its limitations.
(a) cordial (b) intimate (c) secret (d) pleasant
20. **[GA-2013 (1 mark)]:** Universalism is to particularism as diffuseness is to _____.
(a) specificity (b) neutrality (c) generality (d) adaptation
21. **[GA-2014 (1 mark)]:** One of his biggest _____ was his ability to forgive.
(a) vice (b) virtues (c) choices (d) strength
22. **[GA-2014 (1 mark)]:** _____ is the key to their happiness; they are satisfied with what they have.
(a) Contentment (b) Ambition (c) Perseverance (d) Hunger
23. **[GA-2014 (1 mark)]:** He could not understand the judges awarding her the first prize, because he thought that her performance was quite _____.
(a) superb (b) medium (c) mediocre (d) exhilarating
24. **[GA-2014 (1 mark)]:** Many ancient cultures attributed to supernatural causes. However, modern science has largely helped _____ such notions.
(a) impel (b) dispel (c) propel (d) repel
25. **[GA-2014 (1 mark)]:** The value of one U.S. dollar is 65 Indian Rupees today, compared to 60 last year. The Indian Rupee has _____.
(a) depressed (b) depreciated (c) appreciated (d) stabilized
26. **[GA-2014 (1 mark)]:** After the discussion, Tom said to me, 'Please revert!' He expects me to __.
(a) retract (b) get back to him (c) move in reverse (d) retreat
27. **[GA-2015 (1 mark)]:** The principal presented the chief guest with a _____, as a token of appreciation.

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(a) momento (b) memento (c) momentum (d) moment

28. [GA-2015 (1 mark)]: Frogs _____.
(a) croak (b) roar (c) hiss (d) patter

29. [GA-2015 (1 mark)]: "Apparent lifelessness _____ dormant life".
(a) harbours (b) leads to (c) supports (d) affects

30. [GA-2015 (1 mark)]: That boy from the town was a _____ in the sleepy village.
(a) dog out of herd (b) sheep from the heap
(c) fish out of water (d) bird from the flock

31. [GA-2015 (1 mark)]: Extreme focus on syllabus and studying for tests has become such a dominant concern of Indian students that they close their minds to anything _____ to the requirements of the exam.
(a) related (b) extraneous (c) outside (d) useful

32. [GA-2015 (1 mark)]: The official answered _____ that the complaints of the citizen would be looked into.
(a) respectably (b) respectfully (c) reputably (d) respectively

33. [GA-2015 (1 mark)]: Let us _____.
(a) introvert (b) alternate (c) atheist (d) altruist

34. Women have always _____ the religious and social duties of their husbands by participating in them equally.
(a) divided (b) dealt (c) administered (d) yielded

35. Even though the surface of the ocean seems smooth, as we look at it, it is _____ at the floor.
(a) disproportionate (b) unequal (c) irregular (d) unsteady

36. Inventing something new can prove to be a/an _____ deal, as one might have to borrow loans also for completing the undertaken projects.
(a) fancy (b) expensive (c) lavish (d) reasonable

37. With no plants to use as food in deepest seas, there goes on a _____ among the animals there to survive upon each other.
(a) mission (b) pursuit (c) voyage (d) expedition

38. The _____ love for sweets is the test of a real sweets lover.
(a) critical (b) heterogeneous (c) selective (d) definite

39. The attempt to be a jack of all trades can prove to be _____ as one master everything in this world.
(a) favourable (b) miraculous (c) propitious (d) catastrophic

40. With the rising cost of technological _____, the services meant to provide enlightenment to the masses are fast becoming slaves to big money.
(a) array (b) gear (c) apparatus (d) munitions

41. Because most of them lack recreational facilities, high rise apartments have been criticized in recent years as _____ for families with children.
(a) unsuitable (b) degrading (c) important (d) inevitable

42. It is impossible for a serious scholar to condone this _____ dismissal of respected theories.
(a) astute (b) cavalier (c) sagacious (d) necessary

43. The descriptions in these essays range widely, from the fanciful to the matter-of-fact, from the _____ to the fatuous, from the objective to the _____.
(a) witty, realistic (b) meagre, descriptive
(c) insightful, impressionistic (d) inane, commonplace

44. Although the colonist resented the new British laws, they _____ them as long as England did not _____ them too strenuously.
(a) rejected, define (b) amended, follow (c) tolerated, enforce (d) defied, interpret

45. Those who seek the advice of scientists in this matter should recognize that, because the knowledge available is _____. The reliability of the advice cannot be _____.
(a) technical…documented (b) coherent…explained
(c) explicit…understood (d) inadequate…guaranteed

46. Until the mid- 1800's, the occasional reports by Asian explorers of the existence of gorillas were generally disbelieved and swiftly _____ the realm of tall tales.
(a) extracted from (b) confused with (c) relegated to (d) compared to

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47. This book has neither merit nor distinction, and it all but _____ whatever prestige the author may once have had.
(a) challenges (b) maximizes (c) epitomizes (d) nullifies

48. The starfish's show pulsing action people it in a graceful, seemingly _____ drift, but its tentacles contain poison potent enough to stun a swimming human.
(a) sinister (b) rhythmic (c) murky (d) harmless

49. The murderous capriciousness of Tipu infused his empire with such pervasive _____ that not even the most _____ citizens felt safe.
(a) panic…distinguished (b) paranoia…suspicious
(c) enthusiasm…apathetic (d) unease…oppressed

50. His inclination to succumb to flattery made him _____ to the _____ of people who wished to take advantage of him.
(a) immune…predilection (b) prejudicial…intentions
(c) susceptible…cajolery (d) resistant…blandishments

51. Diversity is essential in spite of the fact that it _____ universal acceptance of a single doctrine.
(a) underlies (b) precludes (c) presupposes (d) entails

52. Her sense of time was oddly _____; ten minutes sometimes seemed like an hour.
(a) credible (b) distorted (c) idealized (d) consistent

53. Narrowing the eyes when startled by a sudden noise or a noxious stimulus is _____ response, serving to reduce the exposure of sense organs to injury.
(a) an imaginative (b) a protective (c) a corrective (d) a therapeutic

54. My suggestions was not so casual as it appeared; I _____ mentioned the election because I know that she wanted to discuss it.
(a) ineptly (b) incessantly (c) inadvertently (d) intentionally

55. Today science, like philosophy, has been _____ in scope: each has _____ its claim to survey all existence and has accepted a province which, it great, is yet smaller than the whole.
(a) limited…reiterated (b) narrowed…resigned
(c) expanded…repudiated (d) fluctuating…denied

56. Despite her fear of heights, she was _____ to be so far up the mountain.
(a) dismayed (b) unwilling (c) ashamed (d) thrilled

57. The metric system is deliberately designed to be simple arithmetically and yet capable of _____ expansion as it becomes necessary to _____ new units of measure.
(a) confusing…record (b) mathematical…memorize
(c) rigid…discard (d) indefinite…invent

58. Salman is not given to explicit statement; his films, which seem hazy because of their psychological _____.
(a) causality (b) poignancy (c) allusiveness (d) conditioning

59. A number of Indians have moved to _____ and operate their own private college in response to the perceived inadequacies of mainstream higher education.
(a) establish (b) educate (c) restrict (d) foreclose

60. In an effort to _____ the sensations of flight during rainy sessions, computer technicians electronically _____ images realistic enough to convince pilots, at least momentarily, that they are actually flying.
(a) imitate…devise (b) raggerate…reproduce
(c) duplicate…erase (d) mulate…compose

61. The importance of science in the practical affairs of modern societies is recognized even by its detractors, but, surprisingly, its positive influence on culture is often _____, even by its _____.
(a) despised…adversaries (b) ascertained…partisans
(c) questioned…champions (d) nullified…assailants

62. The athlete's insistence on self-discipline had become _____; rarely, it seemed, did he allow himself even a minor indulgence.
(a) dilatory (b) obsessive (c) spontaneous (d) infectious

63. According to Bhagat, a novelist should not _____, for sermonizing has no place in good fiction.
(a) invent (b) offend (c) inform (d) preach

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64. The archaeologist enjoyed the _____ life she led while gathering artefacts; she never stayed at any one site long enough to get bored.
(a) stealthy **(b) nomadic** **(c) clamorous** **(d) indiscreet**

65. The supreme Court's reversal of its previous ruling on the issue of State's right _____ its reputation for _____.
(a) sustained…infallibility **(b) compromised…consistency**
(c) bolstered…doggedness **(d) exacerbated…inflexibility**

66. With his sub-four minute mile Mahendru broke a psychological barrier, and inspired thousands of others to attempt to overcome seemingly _____ hurdles.
(a) insurmountable **(b) inane** **(c) trivial** **(d) traumatic**

67. The game of chess is an example of a _____ information system: the pieces sit inertly on the board until the players move them according to known rules.
(a) interactive **(b) passive** **(c) cybernetic** **(d) disruptive**

68. An artist's preliminary sketches are often a _____ of a subject; on the basis of these sketches the artist makes a decision on his or her approach to the final painting.
(a) reconnaissance **(b) caricature** **(c) vignette** **(d) pastiche**

69. Taking antibiotics for a viral infection may, it is true, be _____; however, in certain cases a course of these drugs can actually ward off opportunistic bacterial infections.
(a) justified **(b) enough** **(c) recommended** **(d) ineffective**

70. The revolution in art has not lost its steam; it _____ on as fiercely as ever.
(a) trudges **(b) meanders** **(c) edges** **(d) rages**

71. _____ by nature, Ranveer spoke very little even to his own family members.
(a) Garrulous **(b) Equivocal** **(c) Taciturn** **(d) Gregarious**

72. Unwilling to admit that they had been in error, the researchers tried to _____ their case with more data obtained from dubious sources.
(a) ascertain **(b) buttress** **(c) refute** **(d) absolve**

73. After the accident, the nerves to her arm were damaged and so the muscles _____ through disuse.
(a) atrophied **(b) contracted** **(c) elongated** **(d) invigorated**

74. He was treated like a _____ and cast out from his community.
(a) ascetic **(b) prodigy** **(c) prodigal** **(d) pariah**

75. We live in a _____ age; everyone thinks that maximizing pleasure is the point of life.
(a) ubiquitous **(b) propitious** **(c) hedonistic** **(d) corrupt**

76. Our bookshelves at home display a range of books on wide-ranging subjects and in many languages, reflecting the _____ tastes of our family members.
(a) anomalous **(b) eclectic** **(c) arcane** **(d) furtive**

77. Kabir, in the famous novel by Salma, was a _____; he hated the rest of mankind.
(a) misanthrope **(b) hypochondriac** **(c) philanthropist** **(d) sybarite**

78. The cricket match seemed _____ to our guests; they were used to watching sports in which the action is over in a couple of hours at the most.
(a) unintelligible **(b) inconsequential** **(c) interminable** **(d) implausible**

79. His musical tastes are certainly _____; he has recordings ranging from classical piano performances to rock concerts, jazz and even Chinese opera.
(a) antediluvian **(b) eclectic** **(c) harmonious** **(d) sonorous**

80. The crew of the air balloon _____ the sand bags to help the balloon rise over the hill.
(a) capsized **(b) jettisoned** **(c) salvaged** **(d) augmented**

81. Hawkins is _____ in his field; no other contemporary scientist commands the same respect.
(a) disparaged **(b) ignominious** **(c) preeminent** **(d) anachronistic**

82. In a fit of _____ she threw out the valuable statue simply because it had belonged to her ex-husband.
(a) pique **(b) goodwill** **(c) contrition** **(d) pedantry**

83. I cannot conclude this preface without _____ that an early and untimely death should have prevented Ashok from giving a more finished appearance to his works.
(a) rejoicing **(b) lamenting** **(c) affirming** **(d) commenting**

84. The success of the business venture _____ his expectations; he never thought that the firm would prosper.

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(a) confirmed (b) belied (c) nullified (d) fulfilled

85. The professor became increasingly _____ in later years, flying into a rage whenever he was opposed.
(a) taciturn (b) voluble (c) irascible (d) contrite

86. Qualitative research methods used by the company _____ customers' real goals, perceptions, and behaviour, including how they choose interaction channels and why they switch channels.
(a) reveal (b) buttress (c) predict (d) illustrate

87. While he was risking loss of respect from his peers over breaking the law to help his relative, he was treading even more _____ in another respect.
(a) Perilously (b) cautiously (c) evenly (d) suspiciously

88. Although the scientific debate about the importance of kin selection–a dominant theory of animal cooperation–is absolutely _____, the majority of the evolution biologists continues to believe the idea.
(a) Bizarre (b) vitriolic (c) absurd (d) insignificant

89. The increasing acceptance of the notion that the news media is not a(n) _____ commentator upon events, but rather, a mouthpiece for the vested interests of its powerful owners, demonstrates the public's growing _____ large corporations.
(a) disinterested…mistrust of (b) meddlesome…suspicion of
(c) official…apprehension of (d) impartial…satisfaction with

90. Frustrated by her husband's lack of _____, Manisha tried to motivate him to _____ for greater things.
(a) initiative, strive (b) lassitude, invigorate
(c) eloquence, dissuade (d) apathy, mitigate

91. Despite her hearing loss and _____, painful arthritis, my grandmother was a pleasant and surprisingly _____ cat.
(a) mildly, enervated (b) chronically, agile
(c) sympathetically, acute (d) wildly, brittle

92. Anupam's friends recognize that his nervous _____ on meeting strangers belies an underlying gregariousness, while new acquaintances often _____ perceive him as churlish.
(a) chatter, accurately (b) banter, quickly
(c) silences, falsely (d) calmly, nimbly

93. With her relentless energy but diminutive attention span, Aneeta _____ her talents on several potentially exciting but uncompleted projects, much to the dismay of his friends who, while venerating her enthusiasm, _____ her unfocussed nature.
(a) squandered, impugned (b) evinced, parried
(c) burnished, defalcated (d) declared, dodged

94. While the _____ structures of your company's projects are often impressive, it's the internal _____ such as flower pots, working window, etc. that make them truly magical.
(a) incidental, stratagems (b) august, proboscises
(c) external, minutiae (d) occasional, reality

95. Some argue that profiting from terrible suffering by publishing photographic books about natural disasters is shameless _____, but perhaps the practice has the _____ effect of helping us to appreciate the humanity of people living gar away.
(a) presumptuous, specious (b) idolatrous, sedulous
(c) profiteering, salutary (d) foolhardy, laborious

96. A recent Times Poll indicated that many professions have seen a decline in their _____ over the past several years; teaching, in contrast, has _____ more respect over the same time period.
(a) ranks, reflected (b) fortunes, squandered
(c) resources, reversed (d) prestige, reaped

97. Though Ram's colleagues occasionally took the distant look on her face to mean that he was _____, he was actually thoroughly _____ of what happening in the office at all times.
(a) truant, insensible (b) fetching, sedulous
(c) oblivious, cognizant (d) astray, laborious

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98. Wealth and technology wrought by industrialization gave nations in the northern hemisphere strategic _____. This included sophisticated weaponry that could easily overpower the more _____ arms held by the countries of the southern hemisphere.

(a) advantage, rudimentary **(b) adoration, intricate**
(c) consequence, perilous **(d) idolization, elementary**

2.6 Analogy

The word 'Analogy' is an inference or an argument from one particular to another particular. Questions on analogy test the ability of a candidate to understand the relationship between the given two or more words and apply the same relationship to find that asked in the question. There are many ways of establishing a relationship; some of the most common one are given below.

In the following questions we have to select the pair (from the given four options) that best expresses a relationship similar to that expressed in the given pair.

Example [GA-2010 (1 mark)]: Unemployed : Worker
(a) fallow : land (b) unaware : sleeper (c) wit : jester (d) renovated : house
Solution (a): Here the relationship between unemployed and worker is **'no work'**. So from the given options, the same relationship is with fallow and land, because fallow describes land that is not planted with crops.

Example [GA-2010 (1 mark)]: Preamble : Constitution
(a) amendment: law (b) prologue: play (c) episode: serial (d) plot: story
Solution (b): The preamble can be referred to as the preface which highlights the essence of the entire constitution. Thus here the relationship between preamble and constitution is 'happening of an event related to the main event, which had happened before it'. In the same way, prologue refers to the events that have happened before the time when the play begins.

Example [GA-2010 (1 mark)]: Erudition: Scholar
(a) steadfast: mercurial (b) competence: strict (c) skill: craftsman (d) mine: doctor
Solution (c): Erudite means having or containing a lot of specialist knowledge; and scholar means a person who studies a subject in great detail, especially at a university or college. Thus here the relationship between erudition and scholar is 'a person having a detailed knowledge about a subject'. In the same way, a craftsman is a person who is skilled in his job.

Example [GA-2011 (1 mark)]: Gladiator : Arena
(a) dancer : stage (b) commuter : train (c) teacher : classroom (d) lawyer : courtroom
Solution (d): Gladiator and Arena are related to a person who fought another person (or wild animal) in a place until one of them wins, to entertain the public. Thus here the relationship between Gladiator and Arena is 'Worker and Work place'. In the same way, two lawyers argue in a courtroom until one of them wins, especially in public.

Example [GA-2013 (1 mark)]: Water: Pipe
(a) cart: road (b) electricity: wire (c) sea: beach (d) music: instrument
Solution (b): As water flows from the pipe, in the same way, electricity flows from the wire.

Example [GA-2013 (1 mark)]: Medicine: Health
(a) Science: Experiment (b) Wealth: Peace (c) Education: Knowledge (d) Money: Happiness
Solution (c): As by taking medicine our health is improved, in the same way, by pursuing education our knowledge improves.

Example [GA-2013 (1 mark)]: Children : Pediatrician
(a) Adult : Orthopaedist (b) Females : Gynaecologist
(c) Kidney : Nephrologist (d) Skin : Dermatologist

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Solution (b): As the community of doctors who take care of children (which is a person) are called Pediatrician; in the same ways the community of doctors who take care of female (which is a person) are called Gynaecologist.

Exercise: 2.7

In all the following questions select the pair (from the given four options) that best expresses a relationship similar to that expressed in the given pair.

1. Introduction : Conclusion
(a) Announcement : News (b) Greeting : Farewell
(c) Birth : Marriage (d) Landing : Accolade

2. Referee : Field
(a) Experimenter : Result (b) Arbitrator : Deadlock
(c) Gladiator : Fight (d) Judge : Courtroom

3. Comprehend : Unintelligible
(a) Swallow : Edible (b) Circumvent : Risky
(c) Accumulate : Insignificant (d) Control : Ungovernable

4. Incumbent : Office
(a) Monarch : Throne (b) President : Company
(c) Supervisor : Employee (d) Captain : Army

5. Apostate : Religion
(a) Offender : Order (b) Atheist : Faith
(c) Deserter : Duty (d) Adherent : Rule

6. Equanimity : Discompose
(a) Equation : Invert (b) Equitableness : Oppose
(c) Prevarication : Diminish (d) Equilibrium : Unbalance

7. Sedative : Sleep
(a) Challenging : Knowledge (b) Mnemonic : Memory
(c) Dramatic : Story (d) Vocal : Eloquence

8. Palate : Mouth
(a) Kerb : Footpath (b) Rainbow : Sky
(c) Rivulet : Dam (d) Ceiling : Room

9. Vigilant : Danger
(a) Frugal : Indigence (b) Compulsive : Perfection
(c) Capricious : Change (d) Obliging : Rapport

10. Maladroit : Skill
(a) Indignant : Anger (b) Irrational : Intuition
(c) Lazy : Weariness (d) Glib : Profundity

11. Importune : Request
(a) Encourage : Bargain (b) Flatter : Compliment
(c) Surrender : Enslave (d) Conciliate : Placate

12. Colander : Drain
(a) Thermometer : Calibrate (b) Statue : Sculpt
(c) Sluice : Inundate (d) Centrifuge : Separate

13. Farewell : Valediction
(a) Oration : Prediction (b) Fiat : Condescension
(c) Praise : Panegyric (d) Stutter : Hesitation

14. Piano : Hammer
(a) Gramophone : Needle (b) Car : Horn
(c) Bell : Clapper (d) Mouth : Tongue

15. Cinnamon : Spice
(a) Cocoa : Chocolate (b) Lead : Pencil
(c) Salt : Mineral (d) Beet : Sugar

16. Congregation : Worshippers
(a) Personnel : Employees (b) Alms : Philanthropists

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(c) Performance : Audience (d) Puppetry : Players

17. Vindictive : Vengeance
(a) Dull : Accomplishment (b) Hedonistic : Pleasure
(c) Precocious : Youth (d) Interested : Empathy

18. Dilapidated : Restoration
(a) Released : Disclosure (b) Shattered : Collapse
(c) Extinguished : Rekindling (d) Conciliated : Refreshment

19. Irresolute : Vacillate
(a) Barbaric : Retaliate (b) Mendacious : Prevaricate
(c) Charitable : Reciprocate (d) Moody : Aggravate

20. Arid : Moisture
(a) Stagnant : Movement (b) Gruesome : Terror
(c) Unbiased : Balance (d) Damaged : Blemish

21. Whetstone : Sharpen
(a) Pestle : Grind (b) Balloon : Buoy
(c) Mill : Screw (d) Hinge : Move

22. Pleased : Jocose
(a) Calm : Peaceful (b) Modest : Ostentatious
(c) Dreadful : Appalling (d) Unhappy : Lachrymose

23. Butterfly : Caterpillar
(a) Beetle : Worm (b) Frog : tadpole
(c) Vulture : Carrion (d) Horse : Calf

24. Axe : Woodcutter
(a) Pipe : Plumber (b) Crop : Farmer
(c) Lubricant : Mechanic (d) Scythe : reaper

25. Geriatrics : Old People
(a) Dermatology : Skin (b) Pathology : Medicine
(c) Meteorology : Forecast (d) Neurology : Psychiatrists

26. Courageous : Bravado
(a) Circumspect : Discretion (b) Horrific : Hysteria
(c) Complimentary : Fulsomeness (d) Self-centred : Pride

27. Allergy : Reaction
(a) Rash : Skin (b) Scalpel : Instrument
(c) Antihistamine : Symptom (d) Cocoon : Silkworm

28. Pedantic : Learned
(a) Simplistic : Guileless (b) Moralistic : Principled
(c) Positivistic : Experimental (d) Biased : Prejudiced

29. Bacterium : Medium
(a) Meadow : Grass (b) Snake : Egg
(c) Parasite : Host (d) Predator : den

30. Fragment : Bone
(a) Quartz : Stone (b) Rim : Wheel
(c) Ash : Coal (d) Shard : pottery

31. Smile : Pleasure
(a) Scream : Anger (b) Blush : Embarrassment
(c) Laugh : Abuse (d) Subsist : Sentimentality

32. Theocracy : State
(a) Generosity : Saint (b) Pagan : Faith
(c) Anathema : Curse (d) Benediction : Sin

33. Insolvent : Money
(a) Impregnable : Castle (b) Childless : Destitute
(c) Thirsty : Appetite (d) Homeless : Domicile

34. Embryonic : Maturity
(a) Likely : Probability (b) Latent : Characteristic
(c) Nascent : Fruition (d) Constitutional : Democracy

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35. Teacher : Faculty
(a) Umpire : Contest (b) Merchants : Trade
(c) Customer : Clientele (d) Civilian : Army

36. Affection : Embrace
(a) Dilemma : Frustration (b) Fear : Foreboding
(c) Respect : Obeisance (d) Boredom : Listlessness

37. Frieze : Ornament
(a) Pillar : Support (b) Contour : Form
(c) Arabesque : Emphasize (d) Nave : fringe

38. Birds : Aviary
(a) Bees : Grove (b) Cattle : Herd
(c) Sheep : Fold (d) Apes : Jungle

39. Ostracize : Outcast
(a) Dictator : Ruler (b) Lionize : Celebrity
(c) Dishearten : Censor (d) Idolize : Lover

40. Repugnant : Repel
(a) Illogical : Upset (b) Cogent : Convince
(c) Risky : Avoid (d) Fluent : Refine

41. Tenant : Dwelling
(a) Politician : Propaganda (b) Incumbent : Office
(c) Warder : Jail (d) Stenographer : Typewriter

42. Maverick : Convention
(a) Subordinate : Authority (b) Coward : Loyalty
(c) Iconoclast : Dogma (d) Mutineer : Ideology

43. Satirist : Ridicule
(a) Critic : Judgment (b) Physician : Setback
(c) Essayist : Meditation (d) Miser : Generosity

44. Verify : Doubtfulness
(a) Align : Collinear (b) Weary : Monotony
(c) Dissent : Controversy (d) Purify : Imperfection

45. Desolate : Inhabitant
(a) Commodious : Space (b) Barren : Vegetation
(c) Shallow : Danger (d) Residential : House

46. Discombobulated : Pattern
(a) Political : Pandemonium (b) Licentious : Disorder
(c) Erratic : Consistency (d) Rumpled : Dirt

47. Enervate : Vigour
(a) Change : Substance (b) Vindicate : Crime
(c) Verify : Validity (d) Adulterate : purity

48. Embargo : Trade
(a) Curfew : Law (b) Quarantine : Epidemic
(c) Exile : Banishment (d) Allegation : Judgment

49. Cringe : Dread
(a) Fidget : Nervousness (b) Obstruct : Disappointment
(c) Entertain : Amusement (d) Suspect : Anxiety

50. Incline : Precipice
(a) Change : Mutation (b) Selfishness : Generosity
(c) Partisan : Zealot (d) Wilderness : Forest

51. Desiccate : Moisture
(a) Displace : Mass (b) Procreate : Freshness
(c) Implicate : Rationale (d) Dispirit : Morale

52. Coagulant : Bleeding
(a) Hormone : Transformation (b) Enzyme : Assimilation
(c) Narcotic : Addiction (d) Antibiotic : Infection

53. Sickening : Disgust

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(a) Tiring : Patience (b) Thankful : Regret
(c) Formidable : Fear (d) Benevolent : Pity

54. Gerontocracy : Age
(a) Autocracy : Lineage (b) Democracy : Liberty
(c) Aristocracy : Property (d) Plutocracy : Wealth

55. Caulk : Moistness
(a) Dehydrate : Aridness (b) Winnow : Fluffiness
(c) Knock : Glueyness (d) Baste : Dryness

56. Remorseless : Pity
(a) Nefarious : Virtue (b) Guileless : Youth
(c) Charitable : Money (d) Despondent : Sympathy

57. Extol : Praise
(a) Regale : Entertain (b) Instruct : Learn
(c) Embellish : Refresh (d) Fascinate : Repulse

58. Imperturbable : Composure
(a) Circumspect : Impetuosity (b) Chary : Caution
(c) Meticulous : Ingenuity (d) Exigent : Equilibrium

59. Philanthropist : Benevolence
(a) Pilgrim : Temperance (b) Scholar : Imitation
(c) Sage : Wisdom (d) Senator : Diplomacy

60. Judge : Gavel
(a) Detective : Clue (b) Physician : Stethoscope
(c) Referee : Whistle (d) Soldier : Epaulette

61. Stutter : Speech
(a) Blare : Hearing (b) Aroma : Smell
(c) Astigmatism : Sight (d) Novocain : Touch

62. Lustrous : Burnish
(a) Radiant : Reflect (b) Insensible : Numb
(c) Boisterous : Heckle (d) Odious : Sicken

63. Resound : Murmur
(a) Disown : Define (b) Desert : Recede
(c) Dazzle : Glimmer (d) Reflect : Ponder

64. Pain : Agony
(a) Ocean : Stream (b) Fire : Conflagration
(c) Abundance : Colour (d) Flower : Bud

65. Timid : Boldness
(a) Sensitive : Callousness (b) Perfect : Limitlessness
(c) Nervous : Melodrama (d) Concise : Discrimination

Answers

Answer and Explanation: Exercise: 2.1

1. Saccharine means 'a very sweet artificial substance which is used to replace sugar'; so we choose option (b).

2. Jovial means 'friendly and in a good mood'; so we choose (b), i.e., Merry, which means 'happy or showing enjoyment'.

3. Qualm means 'an uncomfortable feeling of doubt about whether you are doing the right thing'; so we choose option (d), i.e., Scruple, which means 'a feeling that prevents you from doing something that you think is morally wrong'.

4. Reverie means 'pleasant dream, like thoughts'; so we choose option (c), i.e., Daydream, which means, 'a set of pleasant thoughts about something you would prefer to be doing or something you would like to achieve in the future'.

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5. Loquacious means 'describing someone who talks a lot'; so we choose option (a), i.e., Talkative, which means 'talking a lot'.
6. Inscrutable means 'not showing emotions or thoughts and therefore very difficult to understand or get to know'; so we choose option (b).
7. Nabob means 'a rich or powerful person'; so we choose option (a), i.e., Bigwig, which means 'a person who has an important or powerful position'.
8. Stentorian means 'using a very loud voice'; so we choose option (c)
9. Deplete means 'to reduce something in size or amount'; so we choose option (c), i.e., Exhaust, which means 'to make someone extremely tired'.
10. Miserable means 'Very unhappy'; so we choose option (c).
11. Refute means 'to say or prove that a person, statement, etc. is wrong'; so we choose option (b), i.e., Deny, which means 'to say something is not true'.
12. Vintage means, 'of old and enduring interest'; so we choose option (a), i.e., Classic, which means 'traditional style which is always fashionable'.
13. Zest means, 'enthusiasm or eagerness'; so we choose option (a), i.e., Gusto, which means 'great energy'.
14. Haggle means 'to attempt to decide on a price or conditions which are acceptable to the person selling the goods and the person buying them, usually by arguing'; so we choose option (d).
15. Throng means 'a crowd or large group of people'; so we choose option (c).
16. Irksome means 'tedious or annoying'; so we choose option (d).
17. Misprize means 'to hold in contempt'; so we choose option (a), i.e., Despise, which means 'to feel a strong dislike for someone or something because you think they are bad or worthless'.
18. Protract means 'to prolong in time and space'; so we choose option (c).
19. Impugn means, 'to cause people to doubt someone's character, quality, etc. by criticising them'; so we choose option (c), i.e., Assail, which means 'to criticise someone strongly'.
20. Exigent means 'needing urgent attention'; so we choose option (a).
21. Fervid means 'intensely enthusiastic or passionate'; so we choose option (d), i.e., Ardent, which means 'showing strong feeling'.
22. Ersatz means 'a usually artificial or inferior substitute'; so we choose option (b).
23. Propinquity means 'the state of being close to someone or something'; so we choose option (b).
24. Redolent means 'smelling strongly of something'; so we choose option (b), i.e., Odorous, which means 'full of specific scent'.
25. Vociferous means, 'loud and insistent, often in presentation of demand or requests'; so we choose option (c), i.e., Strident, which means 'loud and insistent'.
26. Turpitude means 'evil or wickedness'; so we choose option (d), i.e., Depravity, which means 'moral corruption or wickedness'.
27. Infirm means 'ill or needing care, especially for long periods and often because of old age'; so we choose option (b).
28. Lull means 'to cause someone to feel calm or to feel as if they want to sleep; so we choose option (a).
29. Mutiny means 'resistance to lawful authority'; so we choose option (a), i.e., Rebellion, which means 'violent action organised by a group of people who are trying to change the political system in their country'.
30. Malign means 'speak false or harmful things'; so we choose option (c), i.e., Slander, which means 'a false spoken statement about someone which damages their reputation'.
31. (a) Comprehensive means 'complete and including everything that is necessary'; all-inclusive means 'including everything'; circumscribed means 'to limit something'; partial means 'not complete'; demarcate means 'to show the limit of something'.
32. (b) Levity means 'amusement or lack of seriousness, especially during a serious occasion'; gravity means 'seriousness'; frivolity means 'behaving in a silly and foolish way when you should be serious'; gloom means 'feelings of great unhappiness and loss of hope'; depression means 'a feeling of unhappiness and lack of hope for the future'.
33. (c) Morbid means 'too interested in unpleasant subjects, especially death'; Jocund means 'cheerful and light-hearted'; Enraptured means 'filled with great pleasure or extremely pleased by something'; Ghastly means 'unpleasant and shocking'; Joyful means 'very happy'.

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34. (c) Overt means 'done or shown publicly or in an obvious way; not secret:'; Apparent means 'able to be seen or understood'; Patent means 'the official legal right to make or sell an invention for a particular number of years'; Undisguised means 'describes a feeling that is clearly shown or expressed, when it is usually kept hidden'; Manifest means 'to show something clearly, through signs or actions'.

35. (d) Improvised means 'to invent or make something, such as a speech or a device, at the time when it is needed without already having planned it'; Planned means 'to think about and decide what you are going to do or how you are going to do something'; Outlined means 'a description of the main facts about something'; Prospective means 'people who are expected to buy something'; Makeshift means 'temporary and of low quality, but used because of a sudden need'.

36. (a) Denounce means 'to criticize something or someone strongly and publicly'; Excoriate means 'to state the opinion that a play, a book, a political action, etc. is very bad'; Exonerate means 'to show or state that someone or something is not guilty of something'; Exculpate means 'to remove blame from someone'; Exalt means 'to raise someone to a higher rank or more powerful position'.

37. (d) Illiteracy means 'knowing little or nothing about a particular subject'; Cognition means 'when you think or use a conscious mental process'; Grasp means 'to understand quickly'; Perception means 'a belief or opinion, often held by many people and based on appearances'; Oblivion means 'the state of being unconscious'.

38. (b) Sterling means 'of a very high standard, or admirable'; Interesting means 'Someone or something that is interesting keeps your attention because they are unusual, exciting, or have lots of ideas'; Genuine means 'If something is genuine, it is real and exactly what it appears to be'; Irritating means 'making you feel annoyed'; Exciting means 'making you feel excited'.

39. (b) Homage means 'deep respect and often praise shown for a person or god'; Humility means 'the quality of not being proud because you are aware of your bad qualities'; Tribute means 'something that you say, write or give which shows your respect and admiration for someone, especially on a formal occasion'; Obedient means 'doing, or willing to do, what you have been told to do by someone in authority'; Allegiance means 'loyalty and support for a ruler, country, group or belief'.

40. (b) Refrain means 'to avoid doing or stop yourself from doing something'; Dissuade means 'to persuade someone not to do something'; Desist means 'to stop doing something, especially something that someone else does not want you to do'; Prevent means 'to stop something from happening or someone from doing something'; Curb means 'to control or limit something that is not desirable'.

41. (d) Boast means 'to speak too proudly or happily about what you have done or what you own'; Cry means 'to produce tears as the result of a strong emotion, such as unhappiness or pain'; Abuse means 'to use or treat someone or something wrongly or badly, especially in a way that is to your own advantage'; Hate means 'to dislike someone or something very much'; Brag means 'to speak too proudly about what you have done or what you own'.

42. (a) Merit means 'If something merits a particular treatment, it deserves or is considered important enough to be treated in that way'; Deserve means 'to have earned or to be given something because of the way you have behaved or the qualities you have'; Encourage means 'to make someone more likely to do something, or to make something more likely to happen'; Prompt means 'to make something happen'; Support means 'to agree with and give encouragement to someone or something because you want them to succeed'.

43. (b) Corporal means 'of or relating to the body'; Harsh means 'unpleasant, unkind, cruel or unnecessarily severe'; Physical means 'connected with the body'; Unjust means 'not fair'; General means 'involving or relating to most or all people, things or places, especially when these are considered as a unit'.

44. (d) Surreptitious means 'done secretly, without anyone seeing or knowing'; Invisible means 'impossible to see'; Nocturnal means 'happening in or active during the night, or relating to the night'; Secret means 'a piece of information that is only known by one person or a few people and should not be told to others'; Conceal means 'to prevent something from being seen or known about; to hide something'.

45. (a) Sequestered means 'describes a place that is peaceful because it is situated away from people'; Secluded means 'quiet and private by being situated away from people, roads or buildings';

Unhealthy means 'not healthy, see at health'; Disreputable means 'not trusted or respected; thought to have a bad character'; Affluent means 'having a lot of money or owning a lot of things; rich'.

46. (a) Charm means 'a quality which makes you like'; Appeal means 'to interest or attract someone'. Preternatural means 'more than is usual or natural'; Extraordinary means 'very unusual or special'. Reprisal means 'activity against another person'; Retaliation means 'to hurt someone'. Factious means 'false or artificial'; Seditious means 'inciting or causing people to rebel against the authority of a state'.

47. (c) Pretty means 'pleasant to look at'; Beautiful means 'Very attractive'. Manifold means 'many and of several different types'; Diverse means 'varied or different'. Grapple means 'to fight in order to gain something'; Struggle means 'a very great effort in order to do something'. Dire means 'very serious or extreme'.

48. (b) Sundry means 'several different or various'. Venerate means 'to honour a person or thing'; Esteem means 'respect for a good opinion of someone'. Exultant means 'very happy, especially at someone else's defeat or failure'; Jubilant means 'feeling great happiness, especially because of a success'. Supplant means 'to replace'.

49. (d) Spite means 'a desire to hurt'; Malice means 'the wish to harm other people'. Pretension means 'a claim or belief that you can succeed'; Ambition means 'a strong desire for success'. Mundane means 'very ordinary and therefore not interesting'; Commonplace means 'happening frequently or often seen'. Drizzle means 'rain in very small light drops'; Sprinkle means 'to scatter a few bits or drops of something over a surface'.

50. (d) Voluntary means 'made of given willingly, without being forced or paid to do it'. Tart means 'tasting sour or acidic'. Imperial means 'relating to an empire or the person or country that rules it'; Regal means 'very special and suitable for a king or queen'. Corner means 'the point, area or line which is form by intersection of two lines, surfaces, etc.'.

51. (a) Hinder means 'to limit the ability of someone to do something'; Check means 'to make certain that something or someone is correct'. Diffuse means 'to spread in many directions'; Scatter means 'to move far apart in different directions'. Latent means 'present but needing particular condition to become active'; Dormant means 'having normal physical functions suspended or slowed down for a period of time'. Wretched means 'unhappy, unpleasant or of low quality'.

52. (c) Regulate means 'to control something, especially by making it work in a particular way'. Warrant means 'to make a particular activity necessary'; Justify means 'to give or to be a good reason for'. Rigor means 'thoroughness and exhaustiveness'; Austerity means 'without comfort'. Discrete means 'having a clear independent shape or form, separate'.

53. (b) Remote means 'far away in distance'; Distant means 'far away'. Detest means 'to hate someone or something very much'. Gracious means 'behaving in a pleasant, polite, calm way'. Kin means 'family and relatives'.

54. (d) Banish means 'to send someone away especially from their country and forbid them to come back'; Exile means 'the condition of someone being sent or kept away from their own country, village, etc.'. Fraud means 'the crime of obtaining money by deceiving people'; Imposter means 'a person who pretend to someone else in order to deceive others'. Drag means 'to move something by pulling it along a surface'. Indifferent means 'not caring about or interested in someone or something'.

55. (c) Charisma means 'compelling attractiveness or charm that can inspire devotion in others'. Generic means 'relating to a whole group of similar things, rather than to any particular thing'. Wary means 'not completely trusting or certain about something or someone'; Cautious means 'describes someone who avoids risks'. Sumptuous means 'luxurious and showing wealth'.

56. (c) Temerity means 'a willingness to do or say something that shocks or upsets other people'; Audacity means 'a willingness to take bold risks'.

57. (b) Reel mean 'a round wheel-shaped object on which sewing thread or fishing wire, etc. can be rolled'; Whirl means 'to spin around'.

58. (b) Impel means 'to make someone feel that they must do something'; Force means 'strength or power'.

59. (d) Outfit means 'a set of clothes worn for a particular occasion'.

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60. (c) Omit means 'to fail to include or do something'; Prohibit means 'to officially forbid something'.
61. (c) Tumid means 'swollen, or affected with swelling, as a part of the body'; Aggressive means 'behaving in an angry and violent way toward another person'.
62. (a) Wrath means 'extreme anger'; Crime means 'illegal activities'
63. (c) Reform means 'to make an improvement'; Display means 'to arrange something so that it can be seen by the public'.
64. (b) Smudge means 'a mark with no particular shape that is caused by rubbing something such as ink, etc.'; Blur means 'to become difficult to see clearly'.
65. (d) Peer means 'to look carefully or with difficulty'; Recluse means 'a person who lives alone and avoids going outside'.

Answer Keys and Explanation: Exercise: 2.2

1. Impartial means not supporting any of the sides involved in an argument. So we choose option (b), i.e., Biased, which means 'unfairly prejudiced for or against someone or something'.
2. Heartfelt means 'strongly felt and sincere'. So we choose option (b), i.e., Insincere, which means 'pretending to feel something that you do not really feel'.
3. Malodorous means 'having an unpleasant smell'. So we choose option (c), i.e., Fragrant, which means 'having a pleasant smell'.
4. Rotund means 'round or rounded in shape'. So we choose option (c).
5. Pique means 'a feeling of anger and annoyance '. So we choose option (c), i.e., Soothe, which means 'to make someone feel calm or less worried'.
6. Brazen means 'bold and without shame'. So we choose option (a), i.e., Bashful, which means 'tending to feel uncomfortable with other people and be embarrassed easily'.
7. Irascible means 'made angry easily'. So we choose option (d), i.e., Placid, which means 'having a calm appearance'.
8. Philistine means 'describing a person, who is guided by material rather than intellectual values'. So we choose option (b).
9. Quiescent means 'temporarily quiet and not active'. So we choose option (b).
10. Impecunious means 'having very little money, poor'. So we choose option (a), i.e., Wealthy, which means 'rich'.
11. Colossal means 'extremely large'. So we choose option (b), i.e., Tiny, which means 'extremely small'.
12. Gumption means 'initiative or courage'. So we choose option (b), i.e., Apathy, which means 'lack of interest or concern'.
13. Ecstasy means 'a state of extreme happiness'. So we choose option (b), i.e., Agony, which means 'intense pain of mind or body'.
14. Astute means 'clever and quick to see how to take advantage of a situation'. So we choose option (d), i.e., Gullible, which means 'easily deceived or tricked'.
15. Wanton means 'extreme and showing complete lack of care'. So we choose option (a), i.e., Merciful, which means 'describes someone who shows kindness and forgiveness'.
16. Parsimony means 'extreme unwillingness to spend money or use resources'. So we choose option (a), i.e., Generosity, which means 'willing to give money, help or kindness, etc.'.
17. Recondite means 'not known about by many people and difficult to understand'. So we chose option (a), i.e., Manifest, which means 'to show something clearly through signs or actions'.
18. Effluvium means 'an offensive smell'. So we choose option (c), i.e., Fragrance, which means 'a sweet or delicate odour'.
19. Repudiate means 'to refuse to accept something or someone as true, good or reasonable'. So we choose option (d), i.e., Admit, which means 'to agree that something is true'.
20. Pristine means 'unspoiled or pure'. So we choose option (b), which means, 'to spoil something'.
21. Prodigal means 'wasteful with money'. So we choose option (a), i.e., Thrifty, which means 'careful while using money, especially by avoiding waste'.
22. Felicitous means 'suitable or right and expressing well the intended thought or feeling'. So we choose option (c), i.e., Inopportune, which means 'happening or done at a time which is not suitable or convenient'.

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23. Adroit means 'very skilful and quick in the way you think or move'. So we choose option (a), i.e., Clumsy, which means 'awkward in movement or manner'.
24. Wastrel means 'one who expends resources foolishly and self-indulgently'. So we choose option (d), i.e., Miser, which means 'someone who has a great desire to possess money and hates to spend it'.
25. Effete means 'weak and decadent'. So we choose option (b), i.e., Proper, which means 'virtuous or respectable'.
26. Vertiginous means 'causing or experiencing frequent change or inconstant'. So we choose option (c).
27. Entice means 'to persuade someone to do something by offering them something pleasant'. So we choose option (b), i.e., Repulse, which means 'to push away or refuse something or someone unwanted'.
28. Delude means 'to make someone believe something that is not true'. So we choose option (c), i.e., Enlighten, which means 'to explain the true facts about something to someone'.
29. Resilient means 'able to quickly return to a previous good condition'. So we choose option (d), i.e., Flimsy, which means 'lacking in physical strength or substance'.
30. Vacillate means 'to be uncertain what to do or to change frequently between two opinions'. So we choose option (a).
31. Tepid means 'not very warm'. So we choose option (b), i.e., Scalding, which means 'boiling hot'.
32. Ecumenical means 'tending to support and encourage unity between the various types of the Christian religion'. So we choose option (d), i.e., Parochial, which means 'connected with a parish (an area which has its own church or priest)'.
33. Recondite means 'not known about by many peoples and difficult to understand'. So we choose option 'easily recognizable and obvious'.
34. Wean means 'to detach from dependence'. So we choose option (d), i.e., Addict, which means 'to make dependent'.
35. Malice means 'the wish to harm or upset other people'. So we choose option (a), i.e., Goodwill, which means 'friendly and helpful feeling'.
36. Frivolous means 'lacking seriousness'. So we choose option (c).
37. Mendacious means 'not truthful'. So we choose option (c), i.e., Veracious, which means 'truthful or honest'.
38. Indolent means 'lazy or showing no real interest or effort'. So we choose option (a), i.e., Industrious, which means 'hardworking'.
39. Fortuitous means 'not planned, happening by chance'. So we choose option (c), i.e., Deliberate, which means 'intentional or planned'.
40. Epicurean means 'getting pleasure from food and drink of high quality'. So we choose option 'avoiding physical pleasures and living a simple life, often for religious reason'.
41. Gambol means 'to run and jump in a happy and playful way'. So we choose option (a), i.e., Trudge, which means 'to walk slowly with a lot of effort'.
42. Traduce means 'to strongly criticise someone, especially in a way that harms their reputation'. So we choose option (b), i.e., Laud, which means 'to praise'.
43. Bridle means 'to show sudden annoyance'. So we choose option (c), i.e., Vent, which means 'to express a negative emotion in a forceful and often unfair way'.
44. Asperity means 'roughness of surface or manner'. So we choose option (b), i.e., Amenity, which means, 'pleasantness or smoothness of manner'.
45. Lachrymose means 'sad or tending to cry often and easily'. So we choose option (c), i.e., Blithe, which means 'happy and without worry'.
46. (a) Prudent means 'avoiding risks and uncertainties or good judgement'; Foolish means 'ridiculous or lacking in judgment'. Expansive means 'covering a large area'; Narrow means 'limited to a small area'. Benign means 'pleasant and kind'; Malicious means 'intend to harm or upset other people'. Acquaint means 'to get to know or to become friendly'; Alienate means 'to cause unfriendliness or hostility'.
47. (b) Aerate means 'to allow air to act on something'; Suffocate means 'to cause someone to die because of lack of oxygen'. Venerable means 'deserving respect because of age'; Sophomoric means 'silly and childish'. Daunt means 'to make someone feel slightly frightened'; Inspirit

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means 'giving courage'. Paucity means 'a lack of something'; Excess means 'an amount which is more than acceptable'.

48. (c) Ample means 'more than enough'; Insufficient means 'not enough'. Deviant means 'describing a person or behaviour that is not normal'. Abolish means 'to end an activity or custom officially'; Establish means 'to start a company or organisation that will continue for a long time'. Tractable means 'easily dealt with, controlled or persuaded'; Stubborn means 'difficult to handle or manage'.

49. (c) Abound means 'to exist in large number'; Dwindle means 'fewer in number'. Forsake means 'to leave someone forever, especially when they need you'; Embrace means 'to hold someone tightly with both arms to express love, liking, etc.'. Discalced means 'barefoot'; Shod means 'wearing shoes'. Resplendent means 'having a very bright or splendid appearance'; Dowdy means 'not attractive or fashionable'.

50. (c) Confederate means 'ally or accomplice'; Enemy is an opponent. Onerous means 'difficult to do or needing a lot of effort'. Sagacity means 'ability to make good judgements'; Stupidity means 'lacking judgement or intelligence'. Dilettante means 'a person who is or seems to be interested in a subject, but whose understanding of it is not very deep'; Professional means 'a person who engages in a pursuit as a profession'.

51. (b) Unalloyed means 'pure'. Scurrilous means 'expressing unfair or false criticism which is likely to damage someone's reputation'; Descent means 'Socially acceptable or good'. Dyspeptic means 'showing a sour disposition'; Euphoric means 'marked by feeling or well-being'. Heedless means 'not giving attention to a risk or possible difficulty'.

52. (a) Craven means 'extremely cowardly'; Stalwart means 'marked by outstanding strength'. Prolix 'using to many words and therefore boring or difficult to read or listen to'; Brief means 'containing few words'. Lambent means 'shining gently'; Dull means 'lacking in brightness or shine'. Dexterous means 'skilful with the hands'; Clumsy means 'difficult to handle or use'.

53. (a) Waive means 'to not demand something you have a right to'; Retain means 'to keep or continue to have something'. Conserve means 'to keep and protect something from damage or waste'. Abrupt means 'describing something that is sudden and unexpected'; Anticipate means 'to imagine or expect that something will happen'. Erode means 'to rub or be rubbed away gradually'; Restore means 'to return something or someone to an earlier good condition'.

54. (d) Procrastinate means 'to keep delaying something that must be done, often because it is unpleasant or boring'. Docile means 'quiet and easy to influence, persuade or control'; Unruly means 'difficult to control and tend not to obey rules'. Denigrate means 'to deny the importance of something'; Uphold means 'to support or to elevate'. Dormant means 'describes something that is not active or growing'.

55. (b) Brusque means 'quick and rude in manner or speech'; Gracious means 'behaving in a pleasant or polite or calm way'. Callow means 'unsophisticated'; Urbane means 'sophisticated'. Countenance means 'to approve or give support to'; Deny means 'to refuse'. Cachet means 'a quality which makes someone or something as special and worth respect and admiration'; Ignominy means 'Disgrace'.

56. (d) Evince means 'to make obvious or show clearly'; Hide means 'to prevent something from being seen'.

57. (b) Iniquitous means 'very wrong and unfair'; Virtuous means 'having good moral qualities and behaviour'.

58. (c) Mephitic means 'foul, noxious exhalation from the earth which is very unhealthy'.

59. (a) Facultative means 'optional'; Compulsory means 'mandatory or non-optional'.

60. (c) Bemuse means 'to make confused'; Clarify means 'to make free from confusion'.

61. (a) Conversant means 'having knowledge or experience'; Unprepared means 'not prepared, not ready'.

62. (b) Recall means 'to remember'; Rebate means 'an amount of money which is returned to you'.

63. (d) Haste means 'hurry'. Flurry means 'short period of activity'.

64. (c) Taint means 'to spoil something'; Clear means 'having no doubt'.

65. (a) Tedious means 'boring'; Horrible means 'very unpleasant or bad'.

Answer Keys and Explanations: Exercise 2.3

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1. (a) Ignore means 'to intentionally not listen or give attention to'; pass over means 'to ignore or to not give attention to someone or something'; blow up means 'to destroy something or kill someone with a bomb'; call off means 'to decide that a planned event, especially a sports event, will not happen'; give away means 'to give something to someone without asking for payment'.

2. (c) Omit or 'leave out' means 'to not include someone or something'; throw away means 'to get rid of something that you do not want any more'; drop by means 'to visit someone'; pass out means 'to give something to each person in a group of people'.

3. (d) Onlooker means 'someone who watches something that is happening in a public place but is not involved in it'; look see means 'a quick look'; look down means 'to think that someone is less important than you'; look upon means 'to consider or think of someone or something as something'; look on means 'to watch something happen but not become involved in it'.

4. (c) Escape means 'to get free from something, or to avoid something'; broke in means 'force entry to a building'; broke up means 'to divide into many pieces'; broke away means 'to leave or to escape from someone who is holding you'; broke off means 'to separate a part from a larger piece'.

5. (c) Stop means 'to finish doing something that you were doing'; drew out means 'to cause something to last longer than is usual or necessary'; drew on means 'to use information or your knowledge of something to help you do something'; drew up means 'to bring or come to a halt'; drew off means 'to remove a small amount of liquid from a larger amount'.

6. (a) Start means 'to begin doing something'; set off means 'to cause an activity or event, often a series of events, to begin or happen'; set up means 'the way in which things are organized or arranged'; set aside means 'the policy of taking land out of production to reduce crop surpluses'; set about means 'to start to do or deal with something'.

7. (d) Explode means 'to burst violently'; blow off means 'to treat something or someone as if they are not important'; blow in means 'arrive, sometimes suddenly or unexpectedly'; blow over means 'to become gradually less important until it ends and is forgotten'; blow up means 'to destroy something or kill someone with a bomb'.

8. (c) look on means 'watch something like a crime without helping'; look out means 'to watch what is happening and be careful'; look over means 'to quickly examine something or someone'; look out means 'to watch what is happening and be careful'.

9. (d) put by means 'to save an amount of money to use later'; put across means 'to express your ideas and opinions clearly so that people understand them easily'; put out means 'to cause trouble or extra work for someone'; put off means 'to decide or arrange to delay an event or activity until a later time or date'.

10. (a) try out means 'a test to see how useful or effective something or someone is'; try on means 'to put on a piece of clothing to discover if it fits you or if you like it'; try back means 'phone back'; try it on means 'to deceive someone or behave badly'.

11. (b) turn away means 'to not allow someone to enter a place'; turn down means 'to refuse an offer or request'; turn in means 'to produce results, usually good results'; turn into means 'to change and become someone or something different'.

12. (c) call for means 'to go to a place in order to collect someone'; call in means 'to ask someone to come to help in a difficult situation'; call on means 'to visit someone for a short time'; call off means 'to cancel an event'.

13. (d) go on means 'to happen'; go off means 'to become worse in quality'; go for means 'to attack someone'; go over means 'to examine or look at something in a careful or detailed way'.

14. (a) look into means 'to examine the facts about a problem or situation'; look after means 'to take care of or be in charge of someone or something'; look in means 'to visit a person for a short time, usually when you are on your way somewhere else'; look out means 'to watch what is happening and be careful'.

15. (b) take apart means 'to separate something into its different parts'; take after means 'to be similar to an older member of your family in appearance or character'; take on means 'to accept a particular job or responsibility'; take over means 'to start doing a job or being responsible for something that another person did or had responsibility for before'.

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16. (a) get rid of means 'to eliminate'; get around means 'to travel to a lot of places'; get at means 'to criticize a person repeatedly in a way that makes them unhappy'; get behind means 'to fail to do as much work or pay as much money as you should by a particular time'.
17. (b) come to means 'become conscious'; come in means 'to enter a room or building'; come up means 'to move towards someone'; come through means 'producing a result'.
18. (c) go one means 'a way of encouraging someone'; go out means 'to leave a room or building, especially in order to do something for entertainment'; go on means 'to continue or move to the next thing'; go over means 'to examine or look at something in a careful or detailed way'.
19. (a) show up means 'to arrive somewhere in order to join a group of people, especially late or unexpectedly'; show out means 'to go to the door of the building with someone who does not live or work there, when they are leaving'; show over means 'to lead someone around a place that they are visiting in a formal or official way, while telling them about it'; show around means 'to go with someone to all parts, or the main parts, of a place that they have not visited before, so that they can see what it is like or learn about it'.
20. (d) act out means 'to perform the actions and say the words of a situation or story'; act up means 'to behave badly'; act as 'to do a particular job, especially one that you do not normally do'; act upon means 'to affect'.
21. (c) back out means 'to decide not to do something that you had said you would do'; back into means 'to enter a parking area in reverse gear'; back off means 'to stop being involved in a situation, usually in order to allow other people to deal with it themselves'; back up means 'to support or help someone'.
22. (b) be after means 'to be looking for someone or something or trying to find or get them'; be along means 'to arrive'; be in for means 'to be going to experience something unpleasant very soon'; be onto means 'to be aware of someone's true nature'.
23. (d) blow down means 'to fall from wind forces'; blow in means 'to arrive, sometimes suddenly or unexpectedly'; blow off means 'to treat something or someone as if they are not important'; blow away means 'to kill a person by shooting them'.
24. (d) bounce into means 'to force somebody to do something that they do not want to do, usually relating to politics'; bounce off means 'to test an idea'; bounce in means 'to hit or touch something quickly and lightly at an angle and bounce away in another direction'; bounce back means 'to start to be successful again after a difficult period, for example after experiencing failure, loss of confidence, illness or unhappiness'.
25. (a) bring up means 'to start to talk about a particular subject'; bring on means 'to make something happen, usually something bad'; bring out means 'to make a particular quality or detail noticeable'; bring in means 'to introduce something new such as a product or a law'.
26. (a) call off means 'to decide that a planned event, especially a sports event, will not happen, or to end an activity because it is no longer useful or possible'; call in means 'to ask someone to come to help in a difficult situation'; call on means 'to visit someone for a short time'; callout means 'to expose or accuse someone of wrong doing'.
27. (b) drop by means 'to visit someone'; drop around means 'to deliver'; drop away means 'to become smaller in amount, number, etc.'; drop back means 'move towards the back of a group'.
28. (c) eat in means 'to have a meal at home rather than in a restaurant'; eat into means 'to use or take away a large part of something valuable, such as money or time'; eat up means 'to use or take away a large part of something valuable'; eat out means 'to eat in a restaurant'.
29. (c) fly at means 'to attack another person or animal suddenly'; fly by means 'when time appears to move quickly'; fly about 'If ideas, remarks, or accusations are flying about/around, they are passed quickly from one person to another and cause excitement'; fly into means 'to change emotions quickly'.
30. (c) get over means 'to get better after an illness, or feel better after something or someone has made you unhappy'; get onto means 'to start talking about a different subject'; get on means 'to become old'; get through means 'to use up or finish something'.
31. (a) hit back means 'to attack or criticize someone who has attacked or criticized you'; hit for means 'get someone to pay or donate money'; hit on means 'to think of an idea unexpectedly or unintentionally, especially one that solves a problem'; hit up means 'to ask someone for something'.

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32. (b) kick around means 'to discuss informally in a group'; kick back means 'to relax'; kick down means 'to break something with your feet'; kick in means 'to start to have an effect or to happen'.
33. (d) lie about means 'to left in places where they should not be'; lie back means 'to move the top half of your body from a sitting to a lying position'; lie in means 'to exist or be found in something'; lie down means 'a short rest, usually in bed'.
34. (d) pile into means 'to enter a place quickly, in a disorganised way'; pile out means 'to leave a place quickly, in a disorganised way'; pile it on means 'to say too much, especially giving too much emphasis'; pile up means 'to increase something'.
35. (b) root around means 'to search for something, especially by looking through other things'; root for means 'to agree with and give encouragement to someone or something because you want them to succeed'; root out means 'to search and find something or someone that is difficult to find'; root up means 'to remove a whole plant, including the roots, from the ground'.
36. (a) Come apart means 'to separate into several pieces'; break up means 'a gradual division into smaller pieces'; break down means 'to be unable to control your feelings and to start to cry'; break away means 'to leave or to escape from someone who is holding you'; break in means 'to interrupt when someone else is talking'.
37. (b) Bring off means 'to succeed in doing something difficult'; get behind means 'to fail to do as much work or pay as much money as you should by a particular time'; get through means 'to succeed in an exam or competition'; get back means 'to return to a place after you have been somewhere else'; get around means 'to travel to a lot of places'.
38. (d) Dole out means 'to give something to several people'; hand down means 'to pass traditions from older people to younger ones'; hand in means 'to give something to someone in a position of authority'; hand back means 'to return something to the person who gave it to you'; hand out means 'to give something to each person in a group or place'.
39. (a) Dry up means 'if a river, lake, etc. dries up, the water in it disappears'; die away means 'gradually becomes reduced until it stops existing or disappears'; die for means 'excellent or extremely desirable'; die down means 'to becomes quieter or less obvious'; die back is not a phrasal verb.
40. (a) Ease off means 'to gradually stop or become less'; run low means 'to have nearly finished a supply of something'; run down means 'a detailed report'; run for means 'to run fast in order to get or avoid something'; run into means 'to drive a vehicle accidentally into an object or a person in another vehicle'.
41. (c) Fall behind means 'to fail to do something fast enough or on time'; hang on means 'to wait for a short time'; hang onto means 'to keep something'; hang back means 'to be slow to do something, often because of fear or lack of confidence'; hang out means 'to spend a lot of time in a place or with someone'.
42. (c) Fight back means 'to defend yourself when someone attacks you or causes problems for you'; beat down means 'to persuade someone to accept a lower amount of money for something'; beat up means 'to hurt someone badly by hitting or kicking them again and again'; beat off means 'to manage to defeat someone who is attacking you'; beat it means 'to go away'.
43. (b) Get on means 'to deal with a situation, usually successfully'; make into means 'to change something into something else'; make out means 'to deal with a situation, usually in a successful way'; make of means 'particular level of value or importance to something'; make up means 'to prepare or arrange something by putting different things together'.
44. (d) Gear up means 'to prepare for something that you have to do, or to prepare someone else for something'; fit in means 'to feel that you belong to a particular group and are accepted by them'; fit up means 'to make someone appear guilty'; fit in with means 'to exist or happen together in a way that is'; fit out means 'to supply someone or something with all of the things which will be needed'.
45. (a) Hinge on means 'depends on the other thing or is very influenced by other thing'; rest on means 'to depend on someone or something'; rest up means 'to relax in order to have strength for something'; come to rest means 'to stop, usually in a particular place'; rest stop means 'an area next to a road where people can park their vehicles, go to the toilet, eat, etc.'.
46. (c) Hush up means 'to try to prevent people from discovering particular facts'; cover for means 'to provide an excuse'; take cover means 'to seek concealment or protection, as from enemy fire';

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cover up means 'to stop people discovering the truth about something bad'; under cover means 'to be hidden or protected'.

47. (b) jack up means 'to increase the price of something suddenly and by a large amount'; run against means 'to oppose or have an effect that is not helpful towards someone or something'; run up means 'to make the price or value of something increase'; run off means 'to leave somewhere or someone suddenly'; run over 'to continue beyond the expected finishing time'.

48. (a) jot down means 'to write something quickly on a piece of paper so that you remember it'; put down means 'to write someone's name on a list or document, usually in order to include them in an event or activity'; put in means 'to formally offer a particular thing for consideration'; put through means 'to pay for someone to study at school, college or university'; put out means 'to produce information and make it available for everyone to read or hear'.

49. (d) lay down means 'to officially establish a rule'; lay aside 'to stop doing or thinking about something, usually for a short period of time'; lay off means 'to stop using or doing something'; lay out means 'to hit someone so hard that they fall down and become unconscious'.

50. (a) knuckle down means 'to start working or studying hard'; bear down means 'to move in a threatening way towards someone or something'; bear on means 'to be connected or related to'; bear out means 'to support the truth of something'; bear up means 'to deal with a very sad or difficult situation in a brave and determined way'.

51. (c) Light out means 'to leave suddenly'; make out means 'to see, hear or understand something or someone with difficulty'; make over means 'to give something, such as money or land, to someone so that they legally own it'; make off means 'to leave quickly, usually in order to escape'; make of means 'to give a particular level of value or importance to something'.

52. (b) Look for means 'to be looking for someone or something or trying to find or get them'; be in means 'to be going to experience something unpleasant very soon'; be after means 'to be looking for someone or something or trying to find or get them'; be out means 'to be absent from a place'; be up means 'to be increased or risen'.

53. (a) Mess up means 'to spoil or damage something, or to do something wrong or badly'; screw up means 'to make a mistake, or to spoil something'; screw out of means 'to obtain something from someone by using force or threats'; screw around means 'to have sex with a lot of people or with people other than your husband or wife'; screw it means 'used when expressing extreme anger or annoyance'.

54. (d) Muscle in means 'to force your way into a situation and make certain you are included, although you are not wanted'; break away means 'to leave or to escape from someone who is holding you'; break off means 'to separate a part from a larger piece, or to become separate'; break out means 'to escape from prison'; break in means 'to interrupt when someone else is talking'.

55. (a) Nail down means 'to understand something completely, or to describe something correctly'; pin down means 'to discover exact details about something'; pin on means 'to blame someone for something, especially for something they did not do'; pin up means 'to fix something to a wall'; pint at is not a phrasal verb.

56. (c) polish up means 'to improve a skill, especially when you have allowed it to become less good over a period of time'; touch in means 'to draw or paint a detail in a larger painting with quick light marks'; touch off means 'to cause a violent or difficult series of events to suddenly begin'; touch up means 'to improve something by making small changes or additions'; touch on means 'to mention a subject briefly when speaking or writing about another subject'.

57. (b) pull apart means 'to separate two things or people'; cut back means 'to do less of something or use something in smaller amounts'; cut up means 'to cut something into pieces'; cut in means 'to interrupt what someone is saying by saying something yourself'; cut out means 'to make a sudden sideways movement out of a line of traffic'.

58. (d) Ride on means 'to be depend on'; count against means 'to make someone or something more likely to fail'; count in means 'to include someone in an activity or arrangement'; count out means 'to keep someone out or omit them from an activity or arrangement'; count on means 'to be confident that you can depend on someone'.

59. (b) Roll by means 'if an amount of time rolls by, it passes'; pass as means 'to appear to be someone or something else, or to cause people to believe that they are'; pass by means 'if an

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event or opportunity passes you by, you do not properly notice it, or get pleasure or benefit from it'; pass on 'to give someone something that another person has given you'; pass around means 'to offer something to each person in a group of people'.

60. (a) Rub out means 'to murder someone'; knock off means 'to murder someone'; knock out means 'to defeat a person or a team in a competition so that they can no longer take part in it'; knock up means 'to wake someone up by knocking on the door of their house or bedroom'; knock back means 'to quickly drink something, especially a lot of alcohol'.

61. (c) Scrape by means 'to manage with difficulty to get a successful result or to reach an acceptable standard'; bear down on means 'to move in a threatening way towards someone or something'; bear on means 'to be connected or related to'; bear up means 'to deal with a very sad or difficult situation in a brave and determined way'; bear out means 'to support the truth of something'.

62. (d) See about means 'to prepare for or deal with an action or event, or to arrange for something to be done'; reckon in means 'to include an amount in your calculations'; reckon up means 'to calculate the total amount of something'; reckon without means 'to fail to think about something when you are making plans and therefore not be prepared to deal with it'; reckon with means 'to deal with a difficult or powerful person or thing'.

63. (b) Fence off means 'to separate an area with a fence in order to stop people or animals from entering it'; shut in means 'to prevent someone or something from leaving a place, usually by closing or fastening a door or gate'; shut off means 'to prevent something from being reached or seen'; shut up means 'to close a shop or other business for a period of time, usually when business is finished for the day'; shut away means 'to put something in a place where other people cannot see it or get it'.

64. (a) Toy with means 'to consider something or doing something, but not in a very serious way, and without making a decision'; muck around means 'to behave in a silly way, or to treat someone or something in a careless way'; muck in means 'to share the work that needs to be done'; muck out means 'to clean a place where a large animal lives, especially a stable, by removing the excrement and old straw'; muck up means 'to spoil something completely, or do something very badly'.

65. (a) Wimp out means 'to decide not to do something because you are too frightened'; take back means 'to return something you have bought to a shop'; take away means 'to remove something'; take off means 'to suddenly start to be successful or popular'; take out means 'to remove something from somewhere'.

Answer Keys and Explanations: Exercise 2.4

1. (b) Elusive means 'difficult to describe, find, achieve or remember'; Allusive means 'something that is said or written that intentionally makes you think of a particular thing or person'.

2. (c) Personnel means 'the people who are employed in a company, organization or one of the armed forces'.

3. (b) Insured means 'to protect yourself against risk by regularly paying a special company that will provide a fixed amount of money if you are killed or injured or if your home or possessions are damaged, destroyed or stolen'; Ensure means 'to make something certain to happen'.

4. (d) Except means 'not including; but not'.

5. (d) Bail means 'a sum of money which a person who has been accused of a crime pays to a law court so that they can be released until their trial'.

6. (a) Colonel means 'an officer of high rank in the army or air force'.

7. (a) Council means 'a group of people elected or chosen to make decisions or give advice on a particular subject'.

8. (c) Creak means 'when a door or floorboard, etc. creaks, it makes a long low sound when it moves or is moved'.

9. (b) Discreet means 'careful not to cause embarrassment or attract too much attention, especially by keeping something secret'.

10. (b) Doe means 'the female of animals such as the deer or rabbit'.

11. (d) Illicit means 'illegal or disapproved of by society'.

12. (c) Eminent means 'famous, respected or important'.

13. (a) Fare means 'a fee for transportation or food'.

14. (d) Feat means 'something difficult needing a lot of skill, strength, bravery, etc. to achieve it'.

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15. (a) Forth means 'from a place out or away'.
16. (d) Gneiss means 'a banded or foliated metamorphic rock, usually of the same composition as granite'.
17. (b) Gore means 'an animal to cause an injury with the horns or tusks'.
18. (b) Groan means 'a deep long sound showing great pain or unhappiness'.
19. (c) Hale means 'to force or push to go'.
20. (c) Incite means 'to encourage someone to do or feel something unpleasant or violent'.
21. (a) Kneed means 'to hit someone with your knee'.
22. (b) Lessen means 'to make less or decrease'.
23. (d) Lynx means 'a wild animal of the cat family which has brown hair, sometimes with dark spots on it, pointed ears and a short tail'.
24. (a) Lowed means 'to low'.
25. (c) Mince means 'meat, usually beef, which has been cut up into very small pieces'.
26. (b) Mussel means 'a small edible sea animal that lives inside a dark-coloured shell with two parts that close tightly together'.
27. (a) Nay means 'used to introduce a second and more extreme phrase in a sentence when the first phrase was not strong enough:'.
28. (d) Pail means 'a bucket'.
29. (b) Pane means 'a flat piece of glass, used in a window or door'.
30. (b) Pare means 'to cut away the outer layer from something, especially a fruit or a vegetable'.
31. (c) Paw means 'to touch something with a paw'.
32. (a) Pique means 'a feeling of anger and annoyance, especially caused by damage to your feeling of pride in yourself'.
33. (a) Peal means 'when bells peal, they ring with a loud sound'.
34. (a) Pedal means 'a small part of a machine or object which is pushed down with the foot to operate or move the machine or object'.
35. (d) Principle means 'a basic idea or rule that explains or controls how something happens or works'.
36. (d) Root means 'the cause or origin of something bad'.
37. (b) Reed means 'the hollow stem of any of various types of tall stiff grass-like plants growing together in groups near water'.
38. (b) Wrest means 'to obtain something with effort or difficulty'.
39. (c) Choral means 'of music sung by a choir or a chorus'.
40. (c) Shute means 'a narrow, steep slope down which objects or people can slide'.
41. (a) Roe means 'fish eggs, which are eaten as food'.
42. (d) Cymbal means 'a flat round musical instrument made of brass, which makes a loud noise when hit with a stick or against another cymbal'.
43. (d) Dessert means 'sweet food eaten at the end of a meal'.
44. (b) Dew means 'drops of water that form on the ground and other surfaces outside during the night'.
45. (b) Bore means 'to talk or act in a way that makes someone lose interest and become tired'.
46. (c) Seam means 'a line where two things join, especially a line of sewing joining two pieces of cloth or leather'.
47. (c) Surf means 'the tops of the waves on the sea when they approach the coast or hit against rocks'.
48. (c) Serge means 'a strong woollen cloth which is used especially to make jackets and coats'.
49. (c) Shear means 'to have something taken away from you'.
50. (b) Sleigh means 'a type of sledge pulled by animals, especially horses or dogs'.
51. (a) Sole means 'being one only; single'.
52. (b) Stake means 'a strong stick or metal bar with a pointed end'.
53. (d) Sway means 'to move slowly from side to side'.
54. (a) Sundae means 'a food made from ice cream, with pieces of fruit, nuts, cream, sweet sauce, etc. on top of it'.
55. (d) Teem means 'to rain heavily'.
56. (a) Aloud means 'in a voice loud enough to be heard; not silently or quietly'.

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57. (c) Vane means 'a flat narrow part of a fan, propeller, etc. which turns because of the pressure of air or liquid against it'.
58. (c) Vile means 'unpleasant, immoral and unacceptable'.
59. (b) Whet means 'the watery part of milk which is separated from the solid curds during the process of making cheese'.
60. (b) Wine means 'a dark purplish red colour; the colour of red wine'.
61. (d) Ceiling means 'the inner surface of a room which you can see when you look above you'; Sealing means 'an official mark on a document, sometimes made with wax, which shows that it is legal or has been officially approved'.
62. (d) Mettle means 'ability and determination when competing or doing something difficult'; Metal means 'a chemical element, such as iron or gold, or a mixture of such elements, such as steel'.
63. (a) Feint means 'to pretend to move, or to make a move, in a particular direction in order to deceive a competitor'; Faint means 'not strong or clear; slight'.
64. (a) Assent means 'official agreement to or approval of an idea, plan or request'; Ascent means 'the act of ascending, rising or climbing'.
65. (b) Soar means 'to rise very quickly to a high level'; Sore means 'painful and uncomfortable because of injury, infection or too much use'.
66. (c) Stationery means 'the items needed for writing, such as paper, pens, pencils and envelopes'; Stationary means 'not moving, or not changing'.
67. (d) Through means 'from one end or side of something to the other'; Threw means 'to have sent something flying through the air'.
68. (a) Waste means 'an unnecessary or wrong use of money, substances, time, energy, abilities, etc.'; Waist means 'the part of the body above and slightly narrower than the hips'.

Answer Keys: Exercise 2.5

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	b	a	c	d	c	a	c	d	b	b	d	c	d	b	b	a	d	a	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
d	b	b	b	a	b	c	a	b	b	a	b	a	b	a	a	a	c	c	b
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
c	a	a	c	a	a	c	c	a	b	c	b	c	b	d	a	a	b	c	d
61	**62**	**63**	**64**	**65**															
d	b	b	b	d															

Answer Keys and Explanation: Exercise: 2.6

1. (d) Uphold means 'to defend or maintain a principle or law'; Restrain means 'to control the actions or behaviour of someone by force'; Cherish means 'to love, protect and care for someone or something that is important to you'; Conserve means 'to keep and protect something from damage, change or waste'.
2. (c) Masked means 'wearing a mask'; Belied means 'to show something to be false, or to hide something such as an emotion'; Betray means 'to not be loyal to your country or a person'; Suppress means 'to prevent something from being seen or expressed or from operating'.
3. (c) Reasonable means 'based on or using good judgment and therefore fair and practical'; Supportive means 'showing agreement and giving encouragement'; Biased means 'showing an unreasonable like or dislike for a person based on personal opinions'; Fragmented means 'to break something into small parts or to be broken up in this way'.
4. (d) Inevitable means 'certain to happen and unable to be avoided or prevented'; Contingent means 'a group of people representing an organization or country, or a part of a military force'; Oblivious means 'not aware of something, especially what is happening around you'; Imperative means 'extremely important or urgent'.
5. (a) Disincentive means 'something that discourages people from doing something or working hard'; Incite means 'to encourage someone to do or feel something unpleasant or violent'; Restriction means 'limited, especially by official rules, laws, etc.'; Restrain means 'to control the actions or behaviour of someone by force'.

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6. (c) Aberration means 'a temporary change from the typical or usual way of behaving'; Weaken means 'to (cause to) become less strong, powerful or determined'; Decline means 'to gradually become less, worse, or lower'; Deteriorate means 'to become worse'.
7. (b) Deliver means 'to give, direct or aim something'; Forget means 'to be unable to remember a fact'; Renege means 'to fail to keep a promise or an agreement'.
8. (c) Paucity means 'a lack of something'; Propensity means 'a tendency towards a particular way of behaving, especially a bad one'; Preponderance means 'the largest part or greatest amount'; Accurate means 'exact and without any mistakes'.
9. (d) Similar means 'looking or being almost, but not exactly, the same'; Most means 'the biggest number or amount of'; Uncommon means 'not seen, happening or experienced often'; Available means 'able to be obtained, used, or reached'.
10. (c) Identify means 'to recognize someone or something'; Ascertain means 'to discover; to make certain'; Exacerbate means 'to make something which is already bad worse'; Analyse means 'to study or examine something in detail, in order to discover more about it'.
11. (b) Hyperbole means 'a way of speaking or writing that makes someone or something sound bigger, better, more, etc. than they are'; Restrained means 'acting in a calm and controlled way'; Argumentative means 'often arguing or wanting to argue'; Indifferent means 'not caring about or interested in someone or something'.
12. (c) Acerbic means 'describes something that is spoken or written in a way that is direct, clever and cruel'; Resilient means 'able to quickly return to a previous good condition'; Volatile means 'likely to change suddenly and unexpectedly or suddenly become violent or angry'; Heterogeneous means 'consisting of parts or things that are very different from each other'.
13. (d) Insolent means 'rude and not showing respect'; Irate means 'very angry'; Insouciance means 'a relaxed and happy way of acting without worry or guilt'; Curtly means 'rudely brief in speech or abrupt in manner'; Gracious means 'behaving in a pleasant, polite, calm way'; Amiable means 'describes a person or their behaviour that is pleasant and friendly'; Querulous mean 'often complaining, especially in a weak high voice'; Affable means 'friendly and easy to talk to'.
14. (d) Reflective means 'describes a surface which sends back most of the light that shines on it and which therefore can be seen easily'; Utopia means '(the idea of) a perfect society in which everyone works well with each other and is happy'; Luxuriant means 'growing thickly, strongly and well'; Unpopular means 'not liked by many people'.
15. (a) Intrepid means 'extremely brave and showing no fear of dangerous situations'; Inevitable means 'certain to happen and unable to be avoided or prevented'; Inability means 'lack of ability to do something'; Inertness means 'having no inherent power of action, motion or resistance'.
16. (a) Exactitude means 'the quality or state of being accurate and correct'; Mitigate means 'to make something less harmful, unpleasant or bad'.
17. (b) Attempt means 'to try to do something, especially something difficult'; Setback means 'something that happens which delays or prevents a process from advancing'; Meeting means 'an occasion when people come together intentionally or unintentionally'; Delegation means 'a group of delegates'.
18. (d) Beggary means 'a state of extreme poverty'; Nomenclature means 'a system for naming things, especially in a particular area of science'; Jealousy means 'a feeling of unhappiness and anger because someone has something or someone that you want'; Nonchalant means 'behaving in a calm manner, often in a way which suggests lack of interest or care'.
19. (b) Cordial means 'friendly, but formal and polite'; Intimate means 'having, or being likely to cause, a very close friendship or personal or sexual relationship'; Secret means 'a piece of information that is only known by one person or a few people and should not be told to others'; Pleasant means 'enjoyable, attractive, friendly, or easy to like'.
20. (a) Specificity means 'the quality of being specific'; Neutrality means 'the state of not supporting or helping either side in a conflict, disagreement, etc.'; Generality means 'when what someone says contains no details, and often very little meaning'; Adaptation means 'the action or process of adapting or being adapted'.
21. (b) Vice means 'illegal and immoral activities'; Virtue means 'a good moral quality in a person, or the general quality of goodness in people'; Choice means 'an act or the possibility of choosing'; Strength means 'the ability to do things that need a lot of physical or mental effort'.

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22. (a) Contentment means 'a state of happiness and satisfaction'; Ambition means 'a strong desire for success, achievement, power or wealth'; Perseverance means 'continued effort and determination'; Hunger means 'the feeling you have when you need to eat'.
23. (c) Superb means 'of excellent quality; very great'; Medium means 'being in the middle between an upper and lower amount, size, degree or value'; Mediocre means 'not very good'; Exhilarate means 'to give someone strong feelings of happiness and excitement'.
24. (b) Impel means 'to make someone feel that they must do something'; Dispel means 'to remove fears, doubts and false ideas, usually by proving them wrong or unnecessary'; Propel means 'to push or move something somewhere, often with a lot of force'; Repel means 'to force something or someone to move away or stop attacking you'.
25. (b) Depressed means 'unhappy and without hope for the future'; Depreciate means 'to (cause something to) lose value, especially over time'; Appreciate means 'to recognize or understand that something is valuable, important or as described'; Stabilize means 'fixed or stops changing'.
26. (b) Revert means 'return to a previous state or condition or practice, etc.'; Retract means 'to take back an offer or statement, etc. or admit that a statement was false'; Retreat means 'to go away from a place or person in order to escape from fighting or danger'.
27. (b) Momento is not any word; Memento means 'an object that you keep to remember a person, place or event'; Momentum means 'the force that keeps an object moving or keeps an event developing after it has started'; Moment means 'a very short period of time'.
28. (a) When animals such as frogs and crows croak, they call making deep rough sounds.
29. (a) Harbour means 'to have in mind a thought or feeling, usually over a long period'; leads to means 'causes a thing to happen or exist'; Support means 'to agree with and give encouragement to someone or something because you want them to succeed'; Affect means 'to have an influence on someone or something, or to cause them to change'.
30. (c) From the statement it appears that the situation for the boy is very tough to adapt in a very different condition; so we choose option (c).
31. (b) Related means 'connected'; Extraneous means 'not directly connected with or related to something'; Outside means 'the outer part or side of something'; Useful means 'effective; helping you to do or achieve something'.
32. (b) Respectably means 'in a respectable way'; Respectful means 'showing admiration for someone or something'; Reputable means 'having a good reputation and able to be trusted'; Respective means 'relating or belonging to each of the individual people or things you have just mentioned'.
33. (b) Introvert means 'someone who is shy, quiet and unable to make friends easily'; Alternate means 'to happen or exist one after the other repeatedly'; Atheist means 'someone who believes that God or gods do not exist'; Altruist means 'a person unselfishly concerned for or devoted to the welfare of others'.
34. (c) Divide means 'separate into parts or groups'; Dealt means 'to give or share out something'; Administer means 'to manage or govern'; Yield means 'to give up the control of or responsibility for something, often because you have been forced to'.
35. (a) Disproportionate means 'too large or too small in comparison to something else'; Unequal means 'different in size, level, amount, etc.'; Irregular means 'not regular in shape or form; having parts of different shapes or sizes'; Unsteady means 'moving slightly from side to side, as if you might fall:'.
36. (b) Fancy means 'to want to have or do something'; Expensive means 'costing a lot of money'; Lavish means 'more than enough, especially if expensive; very generous'; Reasonable means 'based on or using good judgment and therefore fair and practical:'.
37. (b) Mission means 'any work that someone believes it is their duty to do'; Pursuit means 'when you follow someone or something to try to catch them'; Voyage means 'a long journey'; Expedition means 'speed in doing something'.
38. (b) Critical means 'of the greatest importance to the way things might happen'; Heterogeneous means 'consisting of parts or things that are very different from each other'; Selective means 'intentionally choosing some things and not others'; Definite means 'something that is certain to happen'.

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39. (d) Favourable means 'giving you an advantage or more chance of success'; Miraculous means 'very effective or surprising or difficult to believe'; Propitious means 'likely to result in or showing signs of success'; Catastrophe means 'a sudden event that causes very great trouble or destruction'.

40. (d) Array means 'a large group of things or people'; Gear means 'to design or organize something so that it is suitable for a particular purpose'; Apparatus means 'a set of equipment or tools or sometimes a machine which is used for a particular purpose'; Munitions means 'military weapons such as guns and bombs'.

41. (a) Unsuitable means 'not suitable'; Degrading means 'causing people to feel that they are worthless'; Necessary means 'necessary or of great value'; Inevitable means 'certain to happen and unable to be avoided or prevented'.

42. (b) Astute means 'clever and quick to see how to take advantage of a situation'; Cavalier means 'thoughtless and not caring about other people's feelings or safety'; Sagacious means 'having or showing understanding and the ability to make good judgments; wise'. Necessary means 'needed in order to achieve a particular result'.

43. (c) Witty means 'using words in a clever and funny way'; Realistic means 'seeming to exist or be happening in fact'; Meagre means 'very small or not enough'; Descriptive means 'describing something, especially in a detailed, interesting way'; Insightful means 'having or showing an accurate and deep understanding'; Impressionistic means 'giving a general view or representation of something instead of particular details or facts'; Inane means 'extremely silly or lacking real meaning or importance'; Commonplace means 'happening frequently or often seen or experienced and so not considered to be special'.

44. (c) Reject means 'to refuse to accept,'; Define means 'to say what the meaning of something'; Amend means 'to change the words of a text, typically a law or a legal document'; Follow means 'to move behind someone or something and go where they go'; Tolerate means 'to accept behaviour and beliefs which are different from your own'; Enforce means 'to make people obey a law'; defy means 'to refuse to obey'; Interpret means 'to decide what the intended meaning of something is'.

45. (d) Technical means 'relating to the knowledge'; Document means 'a paper or set of papers with written or printed information'; Coherent means 'logical and consistent'; Explain means 'to make something clear or easy to understand by describing or giving information about it'; Explicit means 'clear and exact'; Understand means 'to know the meaning of something that someone says'; Inadequate means 'not good enough or too low in quality'; Guarantee means 'a promise that something will be done or will happen'.

46. (c) Extract means 'to make someone give you something when they do not want to'; Confused means 'to mix up someone's mind or ideas, or to make something difficult to understand'; Relegate means 'to put someone or something into a lower or less important rank or position'; Compare means 'to judge, suggest or consider that something is similar or of equal quality to something else'.

47. (d) Challenge means 'something needing great mental or physical effort in order to be done successfully and which therefore tests a person's ability'; Maximize means 'to make something as great in amount, size or importance as possible'; Epitomize means 'to be a perfect example of a quality or type of thing'; Nullify means 'to cause something to have no value or effect'.

48. (d) Sinister means 'making you feel that something bad or evil might happen'; Rhythmic means 'describes a sound with a regular movement or beat which is repeated'; Murky means 'describes a situation that is complicated and unpleasant, and about which many facts are unclear'; Harmless means 'not able or not likely to cause harm'.

49. (a) Panic means 'a sudden strong feeling of anxiety or fear that prevents reasonable thought and action'; Distinguish means 'to make one person or thing seem different from another'; Paranoia means 'an extreme and unreasonable feeling that other people do not like you or are going to harm or criticize you'; Suspicious means 'feeling lack of trust or doubt in someone or something'; Enthusiasm means 'a subject or activity that interests you very much'; Apathetic means 'lacking interest or energy'; Unease means 'anxiety or discomfort'; Oppress means 'to govern people in an unfair and cruel way and prevent them from having opportunities and freedom'.

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50. (c) Immune means 'protected against a particular disease by particular substances in the blood'; Predilection means 'a strong liking'; Prejudicial means 'harmful or influencing people unfairly'; Intention means 'something that you want and plan to do'; Susceptible means 'easily influenced or harmed by something'; Cajolery means 'coaxing or flattery intended to persuade someone to do something'; Resistant means 'not wanting to accept something, especially changes or new ideas'; Blandishment means 'pleasant and persuasive words or actions'.

51. (b) Underlie means 'to be a hidden cause of or strong influence on something'; Preclude means 'to prevent something or make it impossible, or prevent someone from doing something'; Presuppose means 'to think that something is true in advance without having any proof'; Entail means 'to make something necessary, or to involve something'.

52. (b) Credible means 'able to be believed or trusted'; Distort means 'to change something from its usual, original, natural or intended meaning, condition or shape'; Idealize means 'to think of or represent someone or something as better than they are'; Consistent means 'always behaving or happening in a similar, especially positive, way'.

53. (b) Imaginative means 'good at producing ideas or things that are unusual, clever or showing skill in inventing'; Protective means 'giving protection'; Corrective means 'intended to improve a situation'; Therapeutic means 'causing someone to feel happier and more relaxed or to be more healthy'.

54. (d) Inept means 'not skilled or effective'; Incessant means 'never stopping, especially in an annoying or unpleasant way'; Inadvertent means 'done unintentionally'; Intentional means 'planned or intended'.

55. (b) Limited means 'restricted in size, amount or extent'; Reiterate means 'to say something again, once or several times'; Narrowed means 'become or make more limited or restricted in extent or scope'; Resigned means 'having accepted something unpleasant that one cannot do anything about'; Expanded means 'being or having been broadened'; Repudiate means 'to refuse to accept something or someone as true, good or reasonable'; Fluctuate means 'to change or vary, especially continuously and between one level or thing and another'; Deny means 'to say that something is not true'.

56. (d) Dismay means 'a feeling of unhappiness and disappointment'; Unwilling means 'not prepared to do something'; Ashamed means 'feeling guilty or embarrassed about something you have done or a quality in your character'; Thrilled means 'extremely pleased'.

57. (d) Confusing means 'describes something that makes you feel confused because it is difficult to understand'; Record means 'to keep information for the future, by writing it down or storing it on a computer'; Mathematical means 'of or relating to mathematics'; Memorize means 'to learn something so that you will remember it exactly'; Rigid means 'stiff or fixed; not able to be bent, moved, changed or persuaded'; Discard means 'to throw something away or get rid of it because you no longer want or need it'; Indefinite means 'not exact, not clear, or without clear limits'; Invent means 'to design and/or create something which has never been made before'.

58. (c) Causality means 'the principle that there is a cause for everything that happens'; Poignancy means 'the quality of evoking a keen sense of sadness or regret'; Allusiveness means 'having reference to something implied or inferred'; Condition means 'to train or influence a person or animal mentally so that they do or expect a particular thing without thinking about it'.

59. (a) Establish means 'to start a company or organization that will continue for a long time'; Educate means 'to teach someone, especially using the formal system of school, college or university'; Restrict means 'to limit the movements or actions of someone, or to limit something and reduce its size or prevent it from increasing'; Foreclose means 'to take back property that was bought with borrowed money because the money was not being paid back as formally agreed'.

60. (a) Imitate means 'to behave in a similar way to someone or something else'; Devise means 'to invent a plan, system, object, etc., usually cleverly or imaginatively'; Raggerate and Mulate are not words.

61. (c) Despise means 'to feel a strong dislike for someone or something because you think they are bad or worthless'; Adversary means 'an enemy'; Ascertain means 'to discover; to make certain'; Partisan means 'strongly supporting a person, principle or political party, often without considering or judging the matter very carefully'; Question means 'to ask a person about something, especially officially'; Champion means 'someone or something, especially a person or

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animal, that has beaten all other competitors in a competition'; Nullify means 'to cause something to have no value or effect'; Assailant means 'a person who attacks another person'.

62. (b) Dilatory means 'slow and likely to cause delay'; Obsessive means 'of the nature of an obsession'; Spontaneous means 'happening or done in a natural, often sudden way, without any planning or without being forced'; Infectious means 'able to infect'.

63. (d) Invent means 'to create a reason, excuse, story etc. which is not true, usually to deceive someone'; Offend means 'to commit a crime'; Inform means 'to tell someone about particular facts'; Preach means 'to give a religious speech'.

64. (b) Stealthy means 'behaving, done, or made in a cautious and surreptitious manner, so as not to be seen or heard'; Nomadic means 'a member of a group of people who move from one place to another rather than living in one place all of the time'; Clamour means 'loud noise, especially made by people's voices'; Indiscreet means 'saying or doing things which let people know things that should be secret or which embarrass people'.

65. (b) Sustain means 'to cause or allow something to continue for a period of time'; Infallible means 'never wrong, failing or making a mistake'; Compromise means 'an agreement in an argument in which the people involved reduce their demands or change their opinion in order to agree'; Consistency 'when someone always behaves or performs in a similar way, or when something always happens in a similar way'; Bolster means 'to support or improve something or make it stronger'; Dogged means 'very determined to do something, even if it is very difficult'; Exacerbate 'to make something which is already bad worse'; Inflexible 'fixed and unable or unwilling to change'.

66. (a) Insurmountable means 'a problem or a difficulty so great that it cannot be dealt with successfully'; Inane means 'extremely silly or lacking real meaning or importance'; Trivial means 'describes a problem that is easy to solve'; Traumatic means 'frightening and causing anxiety'.

67. (b) Interactive means 'involving communication between people'; Passive means 'not acting to influence or change a situation'; Cybernetics means 'the scientific study of how information is communicated in machines and electronic devices in comparison with how information is communicated in the brain and nervous system'; Disruptive means 'causing trouble and therefore stopping something from continuing as usual'.

68. (a) Reconnaissance means 'the process of obtaining information about enemy forces or positions by sending out small groups of soldiers or by using aircraft, etc.'; Caricature means 'a drawing or written or spoken description of someone, which makes part of their appearance or character more noticeable than it really is, and which usually makes them look ridiculous'; Vignette means 'a short piece of writing, music, acting, etc. which clearly expresses the typical characteristics of something or someone'; Pastiche means 'a piece of art, music, literature, etc. which intentionally copies the style of someone else's work or is intentionally in various styles, or the practice of making art in either of these ways'.

69. (d) Justify means 'to give or to be a good reason for'; Enough means 'as much as is necessary; in the amount or to the degree needed'; Recommend means 'to suggest that someone or something would be good or suitable for a particular job or purpose, or to suggest that a particular action should be done'; Ineffective means 'not producing the effects or results that are wanted'.

70. (d) Trudge means 'to walk slowly with a lot of effort, especially over a difficult surface or while carrying something heavy'; Meander means 'a curve of a river or stream'; Edge means 'the outer or furthest point of something'; Rage means 'an exciting or entertaining event involving a lot of activity'.

71. (c) Garrulous means 'having the habit of talking a lot, especially about unimportant things'; Equivocal means 'unclear and seeming to have two opposing meanings, or confusing and able to be understood in two different ways'; Taciturn means 'saying little, especially habitually'; Gregarious means 'of people liking to be with other people, or especially of animals living in groups'.

72. (b) Ascertain means 'to discover; to make certain'; Buttress means 'a structure made of stone or brick, which sticks out from and supports a wall of a building'; Refute means 'to say or prove that a person, statement, opinion, etc. is wrong or false'; Absolve means 'to free someone from guilt, blame or responsibility for something'.

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73. (a) Atrophy means 'to be reduced in size and therefore strength, or, more generally, to become weaker'; Contact means 'to make or become shorter or narrower or generally smaller'; Elongated means 'longer and thinner than usual'; Invigorate means 'to make someone feel fresher, healthier and more energetic'.

74. (d) Ascetic means 'avoiding physical pleasures and living a simple life, often for religious reasons'; Prodigy means 'someone with a very great ability which usually shows itself when that person is a young child'; Prodigal means 'wasteful with money; tending to spend large amounts without thinking of the future'; Pariah means 'a person who is not accepted by a social group, especially because he or she is not liked, respected or trusted'.

75. (c) Ubiquitous means 'seeming to be in all places'; Propitious means 'likely to result in or showing signs of success'; Hedonistic means 'engaged in the pursuit of pleasure'; Corrupt means 'morally bad'.

76. (b) Anomalous means 'deviating from what is standard, normal, or expected'; Eclectic means 'deriving ideas, style or taste from a broad and diverse range of sources'; Arcane means 'mysterious and known only by a few people'; Furtive means 'behaving secretly so that other people do not notice them'.

77. (a) Misanthrope means 'someone who dislikes other people and avoids involvement with society'; Hypochondriac means 'a person who is abnormally anxious about their health'; Philanthropist means 'a person who seeks to promote the welfare of others, especially by the generous donation of money to good causes'; Sybarite means 'a person who loves luxury and pleasure'.

78. (c) Unintelligible means 'impossible to understand'; Inconsequential means 'not important'; Interminable means 'continuing for too long and therefore boring or annoying'; Implausible means 'difficult to believe, or unlikely'.

79. (b) Antediluvian means 'extremely old-fashioned:'; Eclectic means 'Methods, beliefs, ideas, etc. that are eclectic, combine whatever seem the best or most useful things from many different areas or systems, rather than following a single system'; Harmonious means 'having a pleasant tune or harmony'; Sonorous means 'having a deep pleasant sound'.

80. (b) Capsize means 'to (cause a boat or ship to) turn upside down accidentally while on water'; Jettison means 'to throw goods, fuel or equipment from a ship or aircraft to make it lighter'; Salvage means 'to save goods from damage or destruction, especially from a ship that has sunk or been damaged or a building that has been damaged by fire or flooding'; Augment means 'to increase the size or value of something by adding something to it'.

81. (c) Disparage means 'to criticize someone or something in a way that shows you do not respect or value them'; Ignominious means 'embarrassing because so completely a failure'; Preeminent means 'more important or better than others'; Anachronism means 'a person, thing or idea which exists out of its time in history, especially one which happened or existed later than the period being shown, discussed, etc.'.

82. (a) Pique means 'a feeling of anger and annoyance, especially caused by damage to your feeling of pride in yourself'; Goodwill means 'friendly and helpful feelings'; Contrite means 'feeling great regret and guilt for something bad that you have done'; Pedantry means 'excessive concern with minor details and rules'.

83. (b) Rejoicing means 'when you feel or show great happiness about something'; Lament means 'mourn on person's loss or death'; Affirm means 'to state something as true'; Comment means 'something that you say or write that expresses your opinion'.

84. (b) Confirm means 'to make an arrangement or meeting certain, often by telephone or writing'; Belied means 'to show something to be false, or to hide something such as an emotion'; Nullify means 'to make a legal agreement or decision have no legal force'; Fulfil means 'to do something that is expected, hoped for or promised or to cause it to happen'.

85. (c) Taciturn means 'saying little, especially habitually'; Voluble means 'speaking a lot, with confidence and enthusiasm'; Irascible means 'made angry easily'; Contrite means 'feeling great regret and guilt for something bad that you have done'.

86. (a) Reveal means 'to make known or show something that is surprising or that was previously secret'; Buttress means 'to make support for an idea or argument stronger by providing a good reason for it'; Predict means 'to say that an event or action will happen in the future, especially as

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a result of knowledge or experience'; Illustrate means 'to show the meaning or truth of something more clearly, especially by giving examples'.

87. (a) Perilous means 'extremely dangerous'; Cautious means 'describes someone who avoids risks'; Evenly means 'If you say something evenly, you speak without showing emotion in your voice although you are angry or not satisfied in some way'; Suspicious means 'having or showing a cautious distrust of someone or something'.

88. (b) Bizarre means 'very strange and unusual'; Vitriol means 'fierce hate and anger expressed through severe criticism'; Absurd means 'ridiculous or unreasonable'; Insignificant means 'not important or thought to be valuable, especially because of being small'.

89. (a) Disinterested means 'having no personal involvement or receiving no personal advantage, and therefore free to act fairly'; Mistrust means 'to have doubts about the honesty or abilities of someone'; Meddlesome means 'tending to get involved in situations where you are not wanted, especially in a critical, damaging or annoying way'; Suspicion means 'a belief or idea that something may be true'; Official means 'relating to a position of responsibility'; Apprehension means 'anxiety or fear that something bad or unpleasant will happen'; Impartial means 'not supporting any of the sides involved in an argument'; Satisfaction means 'fulfilment of a need or desire'.

90. (a) Initiative means 'the ability to use your judgment to make decisions and do things without needing to be told what to do'; Strive means 'to try very hard to do something or to make something happen, especially for a long time or against difficulties'; Lassitude means 'physical or mental tiredness'; Invigorate means 'to make someone feel fresher, healthier and more energetic:'; Eloquent means 'giving a clear, strong message'; Dissuade means 'to persuade someone not to do something'; Apathy means 'when someone lacks interest or energy and is unwilling to take action especially over a matter of importance'; Mitigate means 'to make something less harmful, unpleasant or bad'.

91. (b) Mild means 'not violent, severe or extreme'; Enervate means 'causing you to feel weak and lacking in energy'; Chronic means 'continuing for a long time'; Agile means 'able to move your body quickly and easily'; Sympathy means 'describes someone who shows that they understand and care about someone's suffering'; Acute means 'if a bad situation is acute, it causes severe problems or damage'; Wild means 'uncontrolled, violent or extreme'; Brittle means 'unkind and unpleasant'.

92. (c) Chatter means 'conversation about things that are not important'; Accurate means 'correct, exact and without any mistakes'; Banter means 'conversation which is amusing and not serious'; Quickly means 'describes someone who is clever and understands or notices things quickly'; Silence means 'a state of not speaking or writing or making a noise'; False means 'not true, but made to seem true in order to deceive people'; Calmly means 'in a quiet or relaxed way'; Nimble means 'quick and exact either in movement or thoughts'.

93. (a) Squander means 'to spend or use money or supplies in a wasteful way, or to waste opportunities by not using them to your advantage'; Impugn means 'to cause people to doubt someone's character, qualities or reputation by criticizing them'; Evince means 'to make obvious or show clearly'; Parry means 'to manage cleverly to avoid dealing with a difficult question or some criticism'; Burnished means 'smooth and shiny'; Defalcate means 'funds with which one has been entrusted'; Declare means 'to announce something clearly'; Dodge means 'to avoid something unpleasant'.

94. (c) Incidental means 'less important than the thing something is connected with or part of'; Stratagem means 'a carefully planned way of achieving or dealing with something, often involving a trick'; August means 'having great importance and especially of the highest social class'; Proboscis means 'the long nose of some animals, or the long tube-like mouth of some insects'; External means 'of, on, for or coming from the outside'; Minutiae means 'small and often unimportant details'; Occasional means 'not happening or done often or regularly'; Reality means 'the state of things as they are, rather than as they are imagined to be'.

95. (c) Presumptuous means 'showing a lack of respect for others by doing things they have no right to do'; Specious means 'seeming to be right or true, but really wrong or false'; Idolatrous means 'treating someone or something as an idol'; Sedulous means 'a person showing dedication and diligence'; Profiteer means 'a person who takes advantage of a situation in which other people are

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suffering to make a profit, often by selling at a high price goods which are difficult to obtain'; Salutary means 'causing improvement of behaviour or character'. Foolhardy means 'foolishly brave, taking unnecessary risks'; Laborious means 'needing a lot of time and effort'.

96. (d) Rank means 'a particular position, higher or lower than others'; Reflect means 'to show, express or be a sign of something'; Fortune means 'a large amount of money, goods, property, etc.'; Squander means 'to spend or use money or supplies in a wasteful way, or to waste opportunities by not using them to your advantage'; Resource means 'a useful or valuable possession or quality of a country, organization or person'; Reverse means 'a defeat or failure'; Prestige means 'respect and admiration given to someone or something, usually because of a reputation for high quality, success or social influence'; Reap means 'to benefit or lose as a result of something you did in the past'.

97. (c) Truant means 'a child who is regularly absent from school without permission'; Insensible means 'unconscious'; Fetch means 'to go to another place to get something or someone and bring them back'; Sedulous means 'a person showing dedication and diligence'; Oblivious means 'not aware of something, especially what is happening around you'; Cognizant means 'having knowledge or being aware of'; Astray means 'away from the correct path or correct way of doing something'; Laborious means 'needing a lot of time and effort'.

98. (a) Advantage means 'a condition giving a greater chance of success'; Rudimentary means 'describes methods, equipment, systems, etc. that are simple and not highly developed'; Adoration means 'very strong love for someone'; Intricate means 'having a lot of small parts or details that are arranged in a complicated way and are therefore sometimes difficult to understand, solve or produce'; Consequence means 'an often bad or inconvenient result of a particular action or situation'; Perilous means 'extremely dangerous'; Idolize means 'to admire and respect someone very much, often too much'; Elementary means 'relating to the early stages of studying a subject'.

Answers and Explanations: Exercise: 2.7

1. (b) Introduction and conclusion are 'antonyms'; greeting (such as good morning) and farewell (such as good-bye) are antonyms.

2. (d) A referee decides in the field; a judge decides in the courtroom. Here the relationship is 'person and his workplace'.

3. (d) Anything that cannot be comprehended (meaning understood) is unintelligible; anything that cannot be controlled is ungovernable. Here the relationship is 'antonym variant'.

4. (a) An incumbent is the occupier of an office; a monarch is the occupier of a throne. Here the relationship is 'defining characteristic'.

5. (c) An apostate is one who has abandoned his faith; a deserter is one who has abandoned his duty. Here relationship is 'definition'.

6. (d) When discomposed (meaning disturbed in composure) one loses one's equanimity (meaning calmness); when unbalanced, one loses one's equilibrium (meaning mental or emotional peace). Here the relationship is 'cause and effect'.

7. (b) A sedative act as an aid to sleep; a mnemonic (such as VIBGYOR, a word made of the first letters of the sequential colours of the rainbow) acts as an aid to memory. Here the relationship is 'thing and purpose'.

8. (d) Palate is the roof of the mouth; ceiling is the roof of the room. Here the relationship is 'definition'.

9. (a) One who is vigilant (meaning watchful) avoids danger; one who is frugal (meaning wise in managing money) avoids indigence (meaning poverty). Here the relationship is 'things avoid by the person'.

10. (d) A maladroit (meaning clumsy) person does not have skill; a glib (meaning thoughtless but voluble) person has no profundity (meaning depth of knowledge or insight). Here the relationship is 'antonym variant'.

11. (b) Importuning (meaning pestering) is an undesirable form of requesting; flattering is an undesirable form of complimenting. Here the relationship is 'desirable and undesirable forms of an action'.

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12. (d) The purpose of a colander (meaning a bowl-shaped kitchen utensil with holes at the bottom) is to drain; purpose of a centrifuge (meaning an apparatus that spins on its axis and separates materials of different specific gravities) is to separate. Here the relationship is 'thing and purpose'.
13. (c) Valediction means formal farewell; panegyric means formal praise. Here the relationship is 'synonym'.
14. (c) The hammer creates sound in a piano by hitting against metal; the clapper creates sound in a bell by hitting against metal. Here the relationship is 'thing and purpose'.
15. (c) Cinnamon is an example of spice, salt is an example of mineral. Here the relationship is 'example and category'.
16. (a) Congregation means a group of worshippers; personnel means a group of employees. Here the relationship is 'collective noun'.
17. (b) A vindictive (meaning vengeful) person seeks vengeance; a hedonistic (meaning giving importance to bodily pleasures) person seeks pleasure. Here the relationship is 'synonym variant'.
18. (c) A dilapidated (meaning fallen into disuse and ruin) structure requires restoration (meaning bringing back to the original condition); an extinguished (meaning put out) lamp requires rekindling (meaning reignited). Here the relationship is 'antonym variant'.
19. (b) An irresolute (meaning indecisive) person vacillates (meaning swings from one opinion to another frequently); a mendacious (meaning untruthful) person prevaricates (meaning evades the truth). Here the relationship is 'synonym variant'.
20. (a) An arid (meaning dry) substance does not have moisture; a stagnant (meaning motionless) object does not have movement. Here the relationship is 'antonym and vocation'.
21. (a) A whetstone is used for sharpening things; a pestle is used for grinding things. Here the relationship is 'thing and purpose'.
22. (d) Jocose (meaning mirthful) is an intensified form of being pleased; lachrymose (meaning tending to weep profusely at the slightest provocation) is an intensified form of being unhappy. Here the relationship is 'degree of intensity'.
23. (b) A butterfly is a metamorphosed form of a caterpillar, a frog is a metamorphosed form of a tadpole. Here the relationship is 'young and the grown-up'. For option (d) 'cow: calf, we could eliminate that choice, because a cow is grown-up calf, but both of them have the same form, unlike 'butterfly and caterpillar' or 'frog and tadpole', etc.)
24. (d) A woodcutter uses an axe in the course of his work; a reaper uses a scythe in the course of his work. Here the relationship is 'person and tool'.
25. (a) Geriatrics deals with diseases of old people; dermatology deals with diseases of the skin. Here the relationship is 'science and subject'.
26. (c) Bravado (meaning foolish courage) is an undesirable form of being courageous. Fulsomeness (meaning excessive but dishonest praise) is an undesirable from of being complimentary. Here the relationship is 'desirable and undesirable forms of a quality'.
27. (b) An allergy (meaning an abnormal sensitivity to certain substances) is a type of reaction; a scalpel (meaning a knife used by a doctor for surgery) is a type of instrument. Here the relationship is 'example and category'.
28. (b) Being pedantic (meaning displaying one's knowledge more than is necessary) is a more intensified and undesirable way of being learned; being moralistic (meaning being unduly concerned about the morals of others) is a more intensified and undesirable way of being principled. Here the relationship is 'desirable and undesirable forms of an action'.
29. (c) A bacterium grows in a medium; a parasite (meaning organism that grows on another organism) grows on a host. Here the relationship is 'habitat'.
30. (d) A fragment is a piece of broken bone; a shard is a piece of broken pottery. Here the relationship is 'part and the whole'.
31. (b) A reference to the first words in the answer choices shows that smile has been used as a verb in this question. Smile signifies pleasure; blush signifies embarrassment. Here the relationship is 'gesture and meaning'. We may not always scream when we are angry. Even otherwise smile and blush are both involuntary facial reaction, whereas screaming is an over act. So, between (a) and (b), it is the latter which is better analogy to the given pair of words.

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32. (c) Theocracy means a religious state; anathema means a religious curse. Here the relationship is 'definition'.
33. (d) An insolvent person has no money; a homeless person has no domicile (meaning place of stay). Here the relationship is 'defining characteristic'.
34. (c) Something which is embryonic (meaning undeveloped) has not attained maturity; something which is nascent (meaning in the initial stages) has not attained fruition (meaning fulfilment). Here the relationship is 'antonym variant'.
35. (c) Faculty is the collective noun for the teachers of an institution; clientele is the collective noun for the customers of a shop. Here the relationship is 'collective noun'.
36. (c) A reference to the second words in the choices shows that embrace is used as a noun here. An embrace is a sign of affection; obeisance (meaning bowing in reverence) is a sign of respect. Here the relationship is 'gesture and meaning'.
37. (a) A reference to the second words in the answer choices shows that ornament is used as a verb in this question. A frieze (meaning a horizontal band of decoration along the walls of a room) is used to ornament a building; a pillar is used to support a building. Here the relationship is 'thing and purpose'.
38. (c) An aviary is a place where birds are kept; a fold (meaning pen for keeping sheep) is a place where sheep are kept. Here the relationship is 'habitat'.
39. (b) To ostracize means to treat a person like an outcast; to lionize means to treat a person like a celebrity. Here the relationship is 'definition'.
40. (b) We are repelled (meaning disgusted) by a repugnant (meaning extremely undesirable) action; we are convinced by a cogent (meaning logical) argument. Here the relationship is 'synonym variant.
41. (b) A tenant occupies a dwelling; an incumbent occupies an office. Here the relationship is 'habitat'.
42. (c) A maverick (meaning a rebel against tradition) does not believe in convention; an iconoclast (meaning a person who is against traditional beliefs) does not believe in dogma (meaning traditional belief). Here the relationship is 'definition'.
43. (a) A satirist (meaning a person who indulges in caustic wit to attack another) indulges in ridicule; a critic indulges in judgment. Here the relationship is 'defining characteristic'.
44. (d) One verifies to remove doubtfulness, one purifies to remove imperfection (meaning defect). Here the relationship is 'action and purpose'.
45. (b) A desolate (meaning deserted) place has not inhabitants; a barren place has not vegetation. Here the relationship is 'definition'.
46. (c) A discombobulated(meaning confusing) arrangement lacks pattern; an erratic (meaning changing) arrangement lacks consistency (meaning regularity). Here the relationship is 'antonym variant'.
47. (d) An enervated (meaning weakened) person lacks vigour (meaning strength); an adulterated (meaning mixed with an inferior ingredient) substance lacks purity. Here the relationship is 'antonym variant'.
48. (b) An embargo (meaning an official restriction on import or export) is intended to curb trade; a quarantine (meaning a compulsory isolation of a person affected by an infectious disease) is intended to curb an epidemic. Here the relationship is 'action and purpose'.
49. (a) One cringes (meaning shrinks back in fear) because of dread (meaning terror); one fidgets (meaning behaves in a restless manner) because of nervousness. Here the relationship is 'cause and its effect'.
50. (c) A precipice (where the inclination is nearly 90 degrees is an extreme case of inclination; a zealot (meaning a fanatic) is an extreme version of partisan (meaning an adherent to party or thought). Here the relationship is 'degree of intensity'. Alteration and mutation do not differ in degree. A selfish person looks first to his own personal interests, but he need not necessarily be greedy, meaning "coveting others' properly also". So, greed and selfishness do not represent different degrees of the same quality.)
51. (d) A desiccated (meaning thoroughly dried out) substance lacks moisture; a dispirited (meaning disheartened) person lacks morale (meaning confidence). Here the relationship is 'cause and effect'.

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52. (d) A coagulant (meaning an agent which transforms blood into a semi-solid mass) acts against bleeding; an antibiotic acts against infection. Here the relationship is 'thing and purpose'.
53. (c) Anything that is sickening causes disgust; anything that is formidable (meaning dreadful) causes fear. Here the relationship is 'synonym variant'.
54. (d) Gerontocracy means a government run by aged persons; plutocracy means a government run by wealthy person. Here the relationship is 'definition'.
55. (d) When you caulk (meaning make watertight) something, you remove moisture from it; when you baste (meaning moisten) something, you remove the dryness from it. Here the relationship is 'action and purpose'.
56. (a) A remorseless (meaning merciless) person lacks pity; a nefarious (meaning evil) Person lacks virtue (meaning goodness). Here the relationship is 'antonym variant'.
57. (a) To extol means to praise to a high degree; to regale means to entertain to a high degree. Here the relationship is 'degree of intensity'.
58. (b) An imperturbable (meaning unshakably calm and collected) person shows composure (meaning a calm state of mind); a chary (meaning very careful) person shows caution. Here the relationship is 'synonym variant'.
59. (c) A philanthropist (meaning a charitable person) is known for his benevolence (meaning generosity); a sage is known for his wisdom. Here the relationship is 'defining characteristic'.
60. (c) A judge uses the gavel (meaning small mallet) for calling the courtroom to order; a referee uses the whistle for calling the players to order. Here the relationship is 'thing and purpose'.
61. (c) A reference to the first words in the answer choices shows that stutter has been used as a noun in this question. Stutter (meaning a speech impediment) is a defect in speech; astigmatism (meaning a visual defect) is a defect in sight. Here the relationship is 'definition'.
62. (b) To burnish (meaning polish) means to make lustrous (meaning shiny); to numb (meaning deprive one of power of feeling) means to make insensible. Here the relationship is 'synonym variant'.
63. (c) Resounding (meaning producing a loud noise) denotes an intensified form of murmuring; dazzling denotes an intensified form of glimmering (meaning giving a faint light). Here the relationship is 'degree of intensity'.
64. (b) An agony is an intensified form of pain; a conflagration is an intensified form of fire. Here the relationship is 'degree of intensity'.
65. (a) A timid person does not show boldness; a sensitive person does not show callousness (meaning emotional hardness). Here the relationship is 'antonym variant'.

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Chapter 3 : Comprehension

Reading comprehension is the ability to read text, process it and understand its meaning. An individual's ability to comprehend text is influenced by their traits and skills, one of which is the ability to make inferences. If word recognition is difficult, you should use too much of their processing capacity to read individual words, which interferes with their ability to comprehend what is read. In all the following passages, you will find it is very easy to answer if you can understand what the given passage is trying to address. While answering the questions based on passage or statements, it is to be noted that: (i) Inference is an idea that is suggested by the facts or details in a passage; (ii) Conclusion is a decision about what may happen or about the result an event may have.

3.1 Comprehension Passage

Example [GA-2010 (2 mark)]: *Modern warfare has changed from large scale clashes of armies to suppression of civilian populations. Chemical agents that do their work silently appear to be suited to such warfare; and regretfully, there exist people in military establishments who think that chemical agents are useful tools for their cause.* Which of the following statements best sums up the meaning of the above passage?
(a) Modern warfare has resulted in civil strife.
(b) Chemical agents are useful in modern warfare.
(c) Use of chemical agents in warfare would be undesirable.
(d) People in military establishments like to use chemical agents in war.
Solution (d): As modern warfare has changed from clashes of armies to suppression of civilian populations, so option (a) is not correct. Also, chemical agents that do their work silently appear to be suited to such warfare, so option (c) is not correct. As some (not all) people in military establishments think that chemical agents are useful tools for their cause, so option (d) is correct because the statement in option (b) is used when all the people think for the use of chemical agents.

Example [GA-2010 (2 mark)]: *The ban on smoking in designated public places can save a large number of people from the well known effects of environmental tobacco smoke. Passive making seriously impairs respiratory health. The ban rightly seeks to protect non-smokers from its ill effects.* Which of the following statements best sums up the meaning of the above passage:
(a) Effects of environmental tobacco are well known.
(b) The ban on smoking in public places protects the non smokers.
(c) Passive smoking is bad for health.
(d) The ban on smoking in public places excludes passive smoking.
Solution (c): Only some effects of environmental tobacco smoke are known so option (a) is not correct. The ban on smoking in public places protects the non smokers from ill effects of passive smoking, so option (b) is not correct. Passive making seriously impairs respiratory health, so option (c) is correct. As the passage tell that the ban on smoking in public places excludes ill effects of passive smoking, so option (d) is not correct.

Example [GA-2010 (2 mark)]: *It has taken fifty six long and frustrating years to turn bronze into gold for India's Olympics aspirations. Beijing 2008 marks a defining moment in India's Olympic history. From Delhi to Beijing is a long journey but one that our Olympians have undertaken with courage.* Which of the following statements best sums up the meaning of the above passage?
(a) India's participation in Olympics has been frustrating.
(b) Beijing Olympics was a landmark in India's Olympic history.
(c) Our Olympians have undertaken a long journey to Beijing.
(d) India's bronze medal turned into gold at Beijing.
Solution (b): Beijing 2008 marks a defining moment (the point at which a situation is clearly seen to start to change) in India's Olympic history, so option (b) is correct, i.e. Beijing Olympics was a landmark (an important stage in something's development) in India's Olympic history.

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Example [GA-2011 (2 mark)]: *Nimbus clouds are dark and ragged, stratus clouds appear dull in colour and cover the entire sky. Cirrus clouds are thin and delicate, whereas cumulus clouds look like cotton balls.* It can be inferred from the passage that
(a) A cumulus cloud on the ground is called fog
(b) It is easy to predict the weather by studying clouds
(c) Clouds are generally of very different shapes, sizes and mass
(d) There are four basic cloud types: stratus, nimbus, cumulus and cirrus
Solution (d): The statements given in option (a) and (b) are not correct as there is no relation between clouds and fog/weather is given in the passage. The statement given in option (c) is not correct because there is no information about 'mass of clouds' is given in the passage. So we are left with the statement given in option (d) which is correct.

Example [GA-2011 (2 mark)]: *The horse has played a little known but very important role in the field of medicine. Horses were injected with toxins of diseases until their blood built up immunities. Then a serum was made from their blood. Serums to fight with diphtheria and tetanus were developed this way.* It can be inferred from the passage that horses were
(a) given immunity to diseases
(b) generally quite immune to diseases
(c) given medicines to fight toxins
(d) given diphtheria and tetanus serums
Solution (b): Horses were injected with toxins of diseases until their blood built up immunities, i.e. horses are immune to diseases. So option (b) is correct.

Example [GA-2011 (2 mark)]: *In order to develop to full potential, a baby needs to be physically able to respond to the environment.* It can be inferred from the passage that
(a) Full physical potential is needed in order for a baby to be able to respond to the environment.
(b) It is necessary for a baby to be able to physically respond to the environment for it to develop its full potential.
(c) Response to the environment of physically able babies needs to be developed to its full potential.
(d) A physically able baby needs to develop its full potential in order to respond to its environment.
Solution (b): From the given passage is can be noted that firstly a baby must be physically able to respond to the environment; and then a baby will develop to full potential. So the statement given in option (b) is correct.

Example [GA-2011 (2 mark)]: *Few school curricula include a unit on how to deal with bereavement and grief, and yet all students at some point in their lives suffer from losses through death and parting.* Based on the above passage which topic would not be included in a unit on bereavement?
(a) how to write a letter of condolence
(b) what emotional stages are passed through in the healing process
(c) what the leading causes of death are
(d) how to give support to a grieving friend
Solution (c): Bereavement means 'the death of a close relative or friend'; grief means 'very great sadness, especially at the death of someone'. So the given passage is dealing with how to deal with bereavement and grief, but not about the causes of death. So option (c) is correct.

Example [GA-2012 (2 mark)]: *The documents expose the cynicism of the government officials - and yet as the media website reflects, not a single newspaper has reported on their existence.* Which one of the following inferences may be drawn with the greatest accuracy from the above passage?
(a) Nobody other than the government officials knew about the existence of the documents.
(b) Newspapers did report about the documents but nobody cared.
(c) Media reports did not show the existence of the documents.
(d) The documents reveal the attitude of the government officials.
Solution (d): From the given passage it is clear that the government officials and the media knew about the document, so the statement in option (a) is not correct. Since the existence of document is reported by media websites but not by any newspaper, so the statements given in option (b) and (c) are not correct. As cynic means 'a person who believes that people are only interested in themselves and are not sincere'; so we can say that the documents reveal the attitude of the government officials; so the statement in option (d) is correct.

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Example [GA-2012 (2 mark)]: *Wanted Temporary, Part-time persons for the post of Field Interviewer to conduct personal interviews to collect and collate economic data. Requirements: High School-pass, must be available for Day, Evening and Saturday work. Transportation paid, expenses reimbursed.* Which one of the following is the best inference from the above advertisement?

(a) Gender-discriminatory (b) Xenophobic
(c) Not designed to make the post attractive (d) Not gender-discriminatory

Solution (c): As in the given advertisement, there is no description about gender so options (a) and (d) are not correct. Xenophobia means 'extreme dislike or fear of foreigners, their customs, their religions, etc.', so option (c) is also not correct. Thus from the given options we choose option (c).

Example [GA-2012 (2 mark)]: *One of the legacies of the Roman legions was discipline. In the legions, military law prevailed and discipline was brutal. Discipline on the battlefield kept units obedient, intact and fighting, even when the odds and conditions were against them.* Which one of the following statements best sums up the meaning of the above passage?

(a) Thorough regimentation was the main reason for the efficiency of the Roman legions even in adverse circumstances.
(b) The legions were treated inhumanly as if the men were animals.
(c) Discipline was the armies' inheritance from their seniors.
(d) The harsh discipline to which the legions were subjected to led to the odds and conditions being against them.

Solution (a): As the Roman legions are obedient, intact and fighting even in adverse conditions so option (a) is correct.

Example [GA-2012 (2 mark)]: *In the early nineteenth century, theories of social evolution were inspired less by Biology than by the conviction of social scientists that there was a growing improvement in social institutions. Progress was taken for granted and social scientists attempted to discover its laws and phases.* Which one of the following inferences may be drawn with the greatest accuracy from the above passage? Social scientists

(a) did not question that progress was a fact. (b) did not approve of Biology.
(c) framed the laws of progress. (d) emphasized Biology over Social Sciences.

Solution (a): From the given passage, it can be noted that progress was considered as true or real and without considering the proof of existence of progress, the social scientists attempted to discover its laws and phases. Thus option (a) is correct.

Example [GA-2013 (2 mark)]: *After several defeats in wars, Robert Bruce went in exile and wanted to commit suicide. Just before committing suicide, he came across a spider attempting tirelessly to have its net. Time and again, the spider failed but that did not deter it to refrain from making attempts. Such attempts by the spider made Bruce curious. Thus, Bruce started observing the near-impossible goal of the spider to have the net. Ultimately, the spider succeeded in having its net despite several failures. Such act of the spider encouraged Bruce not to commit suicide. And then, Bruce went back again and won many a battle, and the rest is history.* Which one of the following assertions is best supported by the above information?

(a) Failure is the pillar of success. (b) Honesty is the best policy.
(c) Life begins and ends with adventures. (d) No adversity justifies giving up hope.

Solution (d): As in his difficult situation, Robert Bruce gave up his hope so he decided to commit suicide. But when he encouraged by the spider he achieved what he wants, so we choose option (d). Options (a) and (c) does not describe about giving up hope, thus these are not correct; there is no discussion of honesty in the given passage so option (b) is not correct.

Example [GA-2013 (1 mark)]: Mahatama Gandhi was known for his humility as

(a) he played an important role in humiliating exit of British from India. (b) he worked for humanitarian causes.
(c) he displayed modesty in his interactions. (d) he was a fine human being

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Solution (c): Humility means 'the quality of not being proud because you are aware of your bad qualities'; so we choose option (c), in which modesty means 'when someone tends not to talk about or make obvious their abilities and achievements'.

Example [GA-2013 (1 mark)]: *You can always give me a ring whenever you need.* Which one of the following is the best inference from the above statement?
(a) Because I have a nice caller tune.
(b) Because I have a better telephone facility.
(c) Because a friend in need is a friend indeed.
(d) Because you need not pay towards the telephone bills when you give me a ring.
Solution (c): A friend in need is a friend indeed means that a friend who helps you when you really need help is a true friend. So option (c) is correct for the given quote.

Example [GA-2013 (2 mark)]: *There were different streams of freedom movements in colonial India carried out by the moderates, liberals, radicals, socialists, and so on.* Which one of the following is the best inference from the above statement?
(a) The emergence of nationalism in colonial India led to our Independence.
(b) Nationalism in India emerged in the context of colonialism.
(c) Nationalism in India is homogeneous.
(d) Nationalism in India is heterogeneous.
Solution (d): Heterogeneous means 'consisting of parts or things that are very different from each other'; so option (d) is correct.

Example [GA-2014 (1 mark)]: *Rajan was not happy that Sajan decided to do the project on his own. On observing his unhappiness, Sajan explained to Rajan that he preferred to work independently.*
Which one of the statements below is logically valid and can be inferred from the above sentences?
(a) Rajan has decided to work only in a group.
(b) Rajan and Sajan were formed into a group against their wishes.
(c) Sajan had decided to give in to Rajan's request to work with him.
(d) Rajan had believed that Sajan and he would be working together.
Solution (d): From the given data we can say that option (d) is correct.

Example [GA-2014 (2 mark)]: *The number of people diagnosed with dengue fever (contracted from the bite of a mosquito) in north India is twice the number diagnosed last year. Municipal authorities have concluded that measures to control the mosquito population have failed in this region.* Which one of the following statements, if true, does not contradict this conclusion?
(a) A high proportion of the affected population has returned from neighbouring countries where dengue is prevalent
(b) More cases of dengue are now reported because of an increase in the Municipal Office's administrative efficiency
(c) Many more cases of dengue are being diagnosed this year since the introduction of a new and effective diagnostic test
(d) The number of people with malarial fever (also contracted from mosquito bites) has increased this year
Solution (d): Municipal authorities have concluded that mosquito population is increased in north region and they are failed to control it. Similarly statements (a), (b) and (c) are also not correct as they are contradicting the conclusion, since more cases of dengue are reported because of statements (a), (b) and (c) implies that there is no role in the increase of mosquito population. On the other hand, the statement (d) is not contradicting the conclusion and thus option (d) is correct.

Example [GA-2014 (1 mark)]: "*India is a country of rich heritage and cultural diversity.*" Which one of the following facts best supports the claim made in the above sentence?
(a) India is a union of 28 states and 7 union territories.
(b) India has a population of over 1.1 billion.
(c) India is home to 22 official languages and thousands of dialects.
(d) The Indian cricket team draws players from over ten states.

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Solution (c): Heritage means 'features belonging to the culture of a particular society, such as traditions, languages or buildings, which still exist from the past and which have a historical importance'; diversity means 'when many different types of things or people are included in something'. Since the cultural diversity is shown in terms of different languages, so the statement given in option (c) is correct.

Example [GA-2014 (1 mark)]: India is a post-colonial country because
(a) it was a former British colony
(b) Indian Information Technology professionals have colonized the world
(c) India does not follow any colonial practices
(d) India has helped other countries gain freedom
Solution (a): Post-colonial means 'occurring or existing after the end of colonial rule or British rule'; so we choose option (a).

Example [GA-2014 (1 mark)]: Which of the following options is the closest in meaning to the sentence below? '*As a woman, I have no country.*'
(a) Women have no country. (b) Women's solidarity knows no national boundaries
(c) Women are not citizens of any country. (d) Women of all countries have equal legal rights.
Solution (b): 'As a woman, I have no country' means 'they do not want to belong to any country or any national boundary'. As 'solidarity' means 'agreement between and support for the members of a group, especially a political group'; so option (b) is correct.

Example [GA-2014 (1 mark)]: *In a press meet on the recent scam, the minister said, "The buck stops here".* What did the minister convey by the statement?
(a) He wants all the money (b) He will return the money
(c) He will assume final responsibility (d) He will resist all enquiries
Solution (c): 'The buck stops here' means 'someone who is responsible for making decisions and who will be blamed if things go wrong'. Thus option (c) is correct.

Example [GA-2014 (2 mark)]: *Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis. From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier.* The main point of the paragraph is:
(a) The twenty-first century is a digital world (b) Big data is obsessed with exactness
(c) Exactitude is not critical in dealing with big data (d) Sparse data leads to a bias in the analysis
Solution (c): Option (a) is not correct as it does not telling any information about the data. Obsessed means 'worried about something'; as the passage is not telling that for exactness we have to worry about big data, thus option (b) is not correct. The passage tells that the sparse data should be handled with care to avoid bias in the analysis, so option (d) is not correct. As the passage conclude that exactness is not critical when dealing with big data; so option (c) is correct.

Example [GA-2014 (2 mark)]: *The Palghat Gap (or Palakkad Gap), a region about 30 km wide in the southern part of the Western Ghats in India, is lower than the hilly terrain to its north and south. The exact reasons for the formation of this gap are not clear. It results in the neighbouring regions of Tamil Nadu getting more rainfall from the South West monsoon and the neighbouring regions of Kerala having higher summer temperatures.* What can be inferred from this passage?
(a) The Palghat gap is caused by high rainfall and high temperatures in southern Tamil Nadu and Kerala
(b) The regions in Tamil Nadu and Kerala that are near the Palghat Gap are low-lying
(c) The low terrain of the Palghat Gap has a significant impact on weather patterns in neighbouring parts of Tamil Nadu and Kerala
(d) Higher summer temperatures result in higher rainfall near the Palghat Gap area

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Solution (c): From the given passage it is clear that because of low terrain of Palghat Gap, the neighbouring regions of Tamil Nadu getting more rainfall from the South West monsoon and the neighbouring regions of Kerala having higher summer temperatures; so we choose option (c) which summarizes the given passage.

Example [GA-2014 (2 mark)]: *Geneticists say that they are very close to confirming the genetic roots of psychiatric illnesses such as depression and schizophrenia, and consequently, that doctors will be able to eradicate these diseases through early identification and gene therapy.* On which of the following assumptions does the statement above rely?
(a) Strategies are now available for eliminating psychiatric illnesses
(b) Certain psychiatric illnesses have a genetic basis
(c) All human diseases can be traced back to genes and how they are expressed
(d) In the future, genetics will become the only relevant field for identifying psychiatric illnesses
Solution (b): From the given passage it is clear that 'only psychiatric illness can be traced back to genes,' so option (c) is not correct; 'strategies will be developed in the future for eliminating psychiatric illness,' so option (a) is not correct; the passage is not saying that the genetics will be the only relevant field for identifying psychiatric illnesses, so option (d) is not correct. As some psychiatric illness, like depression and schizophrenia, have the genetic roots, so option (b) is correct.

Example [GA-2014 (2 mark)]: *The old city of Koenigsberg, which had a German majority population before World War 2, is now called Kaliningrad. After the events of the war, Kaliningrad is now a Russian territory and has a predominantly Russian population. It is bordered by the Baltic Sea on the north and the countries of Poland to the south and west and Lithuania to the east respectively.* Which of the statements below can be inferred from this passage?
(a) Kaliningrad was historically Russian in its ethnic make up
(b) Kaliningrad is a part of Russia despite it not being contiguous with the rest of Russia
(c) Koenigsberg was renamed Kaliningrad, as that was its original Russian name
(d) Poland and Lithuania are on the route from Kaliningrad to the rest of Russia
Solution (b): After World War 2, the old city of Koenigsberg, is now called Kaliningrad, so option (a) and (c) are not correct. Also Kaliningrad is bordered by the Baltic Sea on the north and the countries of Poland to the south and west and Lithuania to the east respectively, so option (d) is not correct and hence option (b) is correct.

Example [GA-2014 (2 mark)]: *By the beginning of the 20th century, several hypotheses were being proposed, suggesting a paradigm shift in our understanding of the universe. However, the clinching evidence was provided by experimental measurements of the position of a star which was directly behind our sun.* Which of the following inference(s) may be drawn from the above passage?
(i) Our understanding of the universe changes based on the positions of stars
(ii) Paradigm shifts usually occur at the beginning of centuries
(iii) Stars are important objects in the universe
(iv) Experimental evidence was important in confirming this paradigm shift
(a) (i), (ii) and (iv) (b) (iii) only (c) (i) and (iv) (d) (iv) only
Solution (d): The given passage is not inferring that our understanding of universe changes based on the position of a star, so statement (i) is not correct. 'Paradigm shifts' means 'when the usual and accepted way of doing or thinking about something is changed'; thus paradigm shifts in our understanding of the universe occur by the beginning of 20^{th} century, thus statement (ii) is not correct. There is no information about what is important object in the universe so statement (iii) is not correct. It is given that 'the clinching evidence was provided by experimental measurements of the position of a star', so statement (iv) is correct. Thus option (d) is correct.

Example [GA-2014 (2 mark)]: *A dance programme is scheduled for 10.00 a.m. Some students are participating in the programme and they need to come an hour earlier than the start of the event. These students should be accompanied by a parent. Other students and parents should come in time for the programme.* The instruction you think that is appropriate for this is
(a) Students should come at 9.00 a.m. and parents should come at 10.00 a.m.

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(b) Participating students should come at 9.00 a.m. accompanied by a parent, and other parents and students should come by 10.00 a.m.
(c) Students who are not participating should come by 10.00 a.m. and they should not bring their parents. Participating students should come at 9.00 a.m.
(d) Participating students should come before 9.00 a.m. Parents who accompany them should come at 9.00 a.m. All others should come at 10.00 a.m.

Solution (b): Clearly the correct way to instruct the students is given by option (b).

Example [GA-2015 (2 mark)]: Read the following paragraph and choose the correct statement. *Climate change has reduced human security and threatened human well being. An ignored reality of human progress is that human security largely depends upon environmental security. But on the contrary, human progress seems contradictory to environmental security. To keep up both at the required level is a challenge to be addressed by one and all. One of the ways to curb the climate change may be suitable scientific innovations, while the other may be the Gandhian perspective on small scale progress with focus on sustainability.*

(a) Human progress and security are positively associated with environmental security.
(b) Human progress is contradictory to environmental security.
(c) Human security is contradictory to environmental security.
(d) Human progress depends upon environmental security.

Solution (b): It is given that *human progress seems contradictory to environmental security*, so options (a) and (d) are not correct and option (b) is correct. Also *human security largely depends upon environmental security* so option (c) is not correct.

Example [GA-2015 (2 mark)]: *Most experts feel that in spite of possessing all the technical skills required to be a batsman of the highest order, he is unlikely to be so due to lack of requisite temperament. He was guilty of throwing away his wicket several times after working hard to lay a strong foundation. His critics pointed out that until he addressed this problem, success at the highest level will continue to elude him.* Which of the statement(s) below is/are logically valid and can be inferred from the above passage?

(i) He was already a successful batsman at the highest level.
(ii) He has to improve his temperament in order to become a great batsman.
(iii) He failed to make many of his good starts count.
(iv) Improving his technical skills will guarantee success.

(a) (iii) and (iv) (b) (ii) and (iii) (c) (i), (ii) and (iii) (d) (ii) only

Solution (b): For a successful batsman at the highest level, the player must have all the technical skill and controlled temperament; so because of lack of requisite temperament the player is not a successful batsman and so statement (i) is not correct; on the other hand if the player successfully improve his temperament then he can become a great batsman and thus statement (ii) is correct. As the player was guilty of throwing away his wicket several times after working hard to lay a strong foundation, so statement (iii) is correct. As the player already have all the technical skill so statement (iv) is not correct. Thus option (b) is correct.

Example [GA-2015 (2 mark)]: *Lamenting the gradual sidelining of the arts in school curricula, a group of prominent artists wrote to the Chief Minister last year, asking him to allocate more funds to support arts education in schools. However, no such increase has been announced in this year's Budget. The artists expressed their deep anguish at their request not being approved, but many of them remain optimistic about funding in the future.* Which of the statement(s) below is/are logically valid and can be inferred from the above statements?

(i) The artists expected funding for the arts to increase this year.
(ii) The Chief Minister was receptive to the idea of increasing funding for the arts.
(iii) The Chief Minister is a prominent artist.
(iv) Schools are giving less importance to arts education nowadays.

(a) (iii) and (iv) (b) (i) and (iv) (c) (i), (ii) and (iv) (d) (i) and (iii)

Solution (c): As artists wrote to the Chief Minister, asking him to allocate more funds to support arts education in schools, so statement (i) is correct. As there is an increase in the budget, so statement (ii)

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is correct. It is given that there is a gradual sidelining of the arts in school curricula, so statement (iv) is correct. As nothing is written about what the Chief Minister is, so statement (iii) is not correct. Thus option (c) is correct.

Example [GA-2015 (2 mark)]: *Humpty Dumpty sits on a wall every day while having lunch. The wall sometimes breaks. A person sitting on the wall falls if the wall breaks.*
Which one of the statements below is logically valid and can be inferred from the above sentences?
(a) Humpty Dumpty always falls while having lunch
(b) Humpty Dumpty does not fall sometimes while having lunch
(c) Humpty Dumpty never falls during dinner
(d) When Humpty Dumpty does not sit on the wall, the wall does not break
Solution (b): As the wall sometimes breaks and sometimes not; so the person sitting on the wall does not fall sometimes. Thus statement given in option (b) is correct.

Example [GA-2015 (2 mark)]: *Alexander turned his attention towards India, since he had conquered Persia.* Which one of the statement below is logically valid and can be inferred from the above sentence?
(a) Alexander would not have turned his attention towards India had he not conquered Persia.
(b) Alexander was not ready to rest on his laurels, and wanted to march to India.
(c) Alexander was completely in control of his army and could command it to move towards India.
(d) Since Alexander's kingdom extended to Indian borders after the conquest of Persia, he was keen to move further.
Solution (a): The given sentence infers that 'if Alexander not conquered Persia, then he had not turned his attention towards India'; thus the statement given in option (a) is logically valid and inferred from the given sentence.

Example [GA-2015 (2 mark)]: *Ms. X will be in Bagdogra from 01/05/2014 to 20/05/2014 and from 22/05/2014 to 31/05/2014. On the morning of 21/05/2014, she will reach Kochi via Mumbai.* Which one of the statements below is logically valid and can be inferred from the above sentences?
(a) Ms. X will be in Kochi for one day, only in May
(b) Ms. X will be in Kochi for only one day in May
(c) Ms. X will be only in Kochi for one day in May
(d) Only Ms. X will be in Kochi for one day in May
Solution (b): From the given information about the schedule of Ms. X, we can infer that 'Ms. X will be in Kochi for only one day in May'. So the statement in option (b) is correct.

Example [GA-2015 (2 mark)]: The given statement is followed by some courses of action. Assuming the statement to be true, decide the correct option. Statement: *There has been a significant drop in the water level in the lakes supplying water to the city.* Course of action:
I. The water supply authority should impose a partial cut in supply to tackle the situation.
II. The government should appeal to all the residents through mass media for minimal use of water.
III. The government should ban the water supply in lower areas.
(a) Statements I and II follow. (b) Statements I and III follow.
(c) Statements II and III follow. (d) All statements follow.
Solution (a): From the given statement the appropriate course of action is minimum use of water which can be done either by course of action I or II. So option (a) is correct.

Example [GA-2016 (2 mark)]: In a world filled with uncertainty, he was glad to have many good friends. He had always assisted them in times of need and was confident that they would reciprocate. However, the events of the last week proved him wrong.
Which of the following inference(s) is/are logically valid and can be inferred from the above passage?
(i) His friends were always asking him to help them.
(ii) He felt that when in need of help, his friends would let him down.
(iii) He was sure that his friends would help him when in need.
(iv) His friends did not help him last week.

(a) (i) and (ii) (b) (iii) and (iv) (c) (iii) only (d) (iv) only
Solution (b): The words in the passage **'was confident that they would reciprocate'** lead to the statement (iii); also the words in the passage '**the events of the last week proved him wrong**' lead to the statement (iv). Hence option (b) is correct.

Example [GA-2016 (2 mark)]: A smart city integrates all modes of transport, uses clean energy and promotes sustainable use of resources. It also uses technology to ensure safety and security of the city, something which critics argue, will lead to a surveillance state.
Which of the following can be logically inferred from the above paragraph?
(i) All smart cities encourage the formation of surveillance states.
(ii) Surveillance is an integral part of a smart city.
(iii) Sustainability and surveillance go hand in hand in a smart city.
(iv) There is a perception that smart cities promote surveillance.
(a) (i) and (iv) only (b) (ii) and (iii) only (c) (iv) only (d) (i) only
Solution (c): Because of modern technology being used to ensure safety and security of the city, it can be inferred from the above passage that smart city promotes surveillance. So option (c) is correct.

Example [GA-2016 (2 mark)]: Social science disciplines were in existence in an amorphous form until the colonial period when they were institutionalized. In varying degrees, they were intended to further the colonial interest. In the time of globalization and the economic rise of postcolonial countries like India, conventional ways of knowledge production have become obsolete.
Which of the following can be logically inferred from the above statements?
(i) Social science disciplines have become obsolete
(ii) Social science disciplines had a pre-colonial origin
(iii) Social science disciplines always promote colonialism
(iv) Social science must maintain disciplinary boundaries
(a) (ii) only (b) (i) and (iii) only (c) (ii) and (iv) only (d) (iii) and (iv) only
Solution (a): 'Until the colonial period' means 'pre-colonial origin'. Other options cannot be inferred. So option (a) is correct.

Example [GA-2016 (2 mark)]: The overwhelming number of people infected with rabies in India has been flagged by the World Health Organization as a source of concern. It is estimated that inoculating 70% of pets and stray dogs against rabies can lead to a significant reduction in the number of people infected with rabies.
Which of the following can be logically inferred from the above sentences?
(a) The number of people in India infected with rabies is high.
(b) The number of people in other parts of the world who are infected with rabies is low.
(c) Rabies can be eradicated in India by vaccinating 70% of stray dogs.
(d) Stray dogs are the main source of rabies worldwide.
Solution (a): Only option (a) can be logically inferred from the information provided in the argument. Option (b) and (d) are not correct because the information in the given passage is about India only. Option (c) is not correct because the word 'eradicated' has been used which means 'to get rid of something completely', however in the passage, it says a significant reduction in number.

Example [GA-2016 (2 mark)]: Indian currency notes show the denomination indicated in at least seventeen languages. If this is not an indication of the nation's diversity, nothing else is.
Which of the following can be logically inferred from the above sentences?
(a) India is a country of exactly seventeen languages.
(b) Linguistic pluralism is the only indicator of a nation's diversity.
(c) Indian currency notes have sufficient space for all the Indian languages.
(d) Linguistic pluralism is strong evidence of India's diversity.
Solution (d): The words 'nothing else is' best inferred by option (d). So, option (d) is correct.

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Example [GA-2016 (2 mark)]: Computers were invented for performing only high-end useful computations. However, it is no understatement that they have taken over our world today. The internet, for example, is ubiquitous. Many believe that the internet itself is an unintended consequence of the original invention. With the advent of mobile computing on our phones, a whole new dimension is now enabled. One is left wondering if all these developments are good or, more importantly, required. Which of the statement(s) below is/are logically valid and can be inferred from the above paragraph?

(i) The author believes that computers are not good for us.
(ii) Mobile computers and the internet are both intended inventions

(a) (i) only (b) (ii) only (c) both (i) and (ii) (d) neither (i) nor (ii)

Solution (b): The statement (i) is not right inference because of last sentence of the given paragraph. The first and second sentences tell us that computers are invented for computation and internet for intended invention. So, statement (ii) is the right inference because of first and second sentences. Hence option (ii) is correct.

Example [GA-2016 (2 mark)]: Today, we consider Ashoka as a great ruler because of the copious evidence he left behind in the form of stone carved edicts. Historians tend to correlate greatness of a king at his time with the availability of evidence today. Which of the following can be logically inferred from the above sentences?

(a) Emperors who do not leave significant sculpted evidence are completely forgotten.
(b) Ashoka produced stone carved edicts to ensure that later historians will respect him.
(c) Statues of kings are a reminder of their greatness.
(d) A king's greatness, as we know him today, is interpreted by historians.

Solution (d): Option (d) is the best inferred by the given sentence '**Historians tend to correlate greatness of a king at his time with the availability of evidence today.**'

Example [GA-2016 (2 mark)]: A poll of students appearing for masters in engineering indicated that 60 % of the students believed that mechanical engineering is a profession unsuitable for women. A research study on women with masters or higher degrees in mechanical engineering found that 99 % of such women were successful in their professions.

Which of the following can be logically inferred from the above paragraph?

(a) Many students have misconceptions regarding various engineering disciplines.
(b) Men with advanced degrees in mechanical engineering believe women are well suited to be mechanical engineers.
(c) Mechanical engineering is a profession well suited for women with masters or higher degrees in mechanical engineering.
(d) The number of women pursuing higher degrees in mechanical engineering is small.

Solution (c): The given passage brings out the opinion of students w.r.t. mechanical engineering only. So option (a) is not inferred.

The statement does not make a specific reference to the options of men with advanced degrees in mechanical engineering. Hence option (b) cannot be inferred.

The research result indicates that nearly all the women with masters or higher degrees in mechanical engineering were successful. Hence option (c) is inferred.

The passage does not provide any information about the number of women pursuing higher degrees in mechanical engineering. Hence option (d) is not inferred.

Example [GA-2016 (2 mark)]: Sourya committee had proposed the establishment of Sourya Institutes of Technology (SITs) in line with Indian Institutes of Technology (IITs) to cater to the technological and industrial needs of a developing country. Which of the following can be logically inferred from the above sentence? Based on the proposal,

(i) In the initial years, SIT students will get degrees from IIT.
(ii) SITs will have a distinct national objective.
(iii) SIT like institutions can only be established in consultation with IIT.
(iv) SITs will serve technological needs of a developing country.

(a) (iii) and (iv) only (b) (i) and (iv) only (c) (ii) and (iv) only (d) (ii) and (iii) only

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Solution (c): Neither (i) nor (iii) is in the scope of the passage. As SITs are being established with a specific purpose, so statement (iii) is inferred. Statement (iv) is a direct extract of the given passage. Thus only statement (ii) and (iv) can be inferred from the given paragraph. So option (c) is correct.

Exercise 3.1
Read the passage and answer the question based on it.

1. *This rule of always trying to do things as well as one can do them has an important bearing upon the problem of ambition. No man or woman should be without ambition, which is the inspiration of activity. But if one allows ambition to drive one to attempt things which are beyond one's own personal capacity, then unhappiness will result. If one imagines that one can do everything better than other people, then envy and jealousy, those twin monsters, will come to sadden one's days. But if one concentrates one's attention upon developing one's own special capacities, the things one is best at, then one does not worry over much if other people are more successful.* Which one of the following statement is correct?
(a) There is a close relationship between ambition and activity
(b) Ambition and activity belong to two different areas
(c) Ambition is useless
(d) Activity is responsible for ambition

2. *Nationalism is only a curse when it becomes narrow and fanatical. Like so many other things available to man, say, religion, it can easily lead men astray. Nationalism can lead people into thinking only of themselves, of their own struggles, of their own misery. It can also cause a nation to become suspicious and fearful of its neighbours, to look upon itself as superior and to become aggressive and it is when nationalism impels a state to become expansionist and seek domination over others that it becomes a positive curse and harmful internationally.* From the passage, which of the following statements most correctly reflect the opinion of the author?
(a) Nationalism makes people self-centred and self-conceited
(b) It helps a nation to become superior to other nations
(c) It regulates international relationship
(d) It helps a nation to expand its territories and become powerful

3. *Brown and his men, huddling round a fire, ate the last of the food that Kassim had brought them that day. Cornelius sat among them, half-asleep. Then, one of the crew remembered that some tobacco had been left in the boat, and said he would go and fetch it. He did not think there was any danger in going to the creek in the dark. He disappeared down the hillside and a moment later he was heard climbing into the boat and then climbing out again.* Consider the following statements: (i) Brown and Cornelius sat round the fire. (ii) Cornelius lay half-asleep at a little distance from the fire. (iii) All the people sat round the fire.
Which of the statements given above is/are correct?
(a) (i) and (ii)
(b) Only (ii)
(c) Only (iii)
(d) (i) and (iii)

4. *As soon as I saw the elephant I knew with perfect certainly that I ought not to shoot him. It is a serious matter to shoot a working elephant. It is comparable to destroying a huge and costly piece of machinery and obviously one ought not to do it if it can possibly be avoided. And at that distance, peacefully eating, the elephant looked no more dangerous than a cow.* The author was against shooting the elephant because
(a) He suspected it to be a wild one and was afraid of it
(b) His heart was full of compassion for animals
(c) He was certain that the elephant was innocent
(d) It would amount to avoidable waste of useful property

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5. *A large number of people had come to attend the meeting to be addressed by the gifted speaker. The organisers had a difficult time keeping the assembled people quiet as the meeting did not commence at the scheduled time. After some time, the people lost their patience and began to shout and heckle. The organisers had great difficulty in assuaging the anger of the crowd when they were forced to cancel the meeting as the speaker had to be hospitalised due to sudden illness.* From the given passage, what was the actual reason for the organisers to have a difficult time?
(a) A large number of people had come to the meeting
(b) The organisers could not male proper arrangements
(c) The meeting could not be started in time
(d) The speaker was ill

6. *Galileo desired to use his telescope to make discoveries in the heavens, but his instrument was too small. He made another and larger telescope which magnified eight times and then another which magnified thirty times and pointed it at the Moon. His heart leaped with joy, for he saw what no human sye had ever before seen ranges of mountains, deep hollows and broad plains! He turned his telescope on the planets and found they appeared with disks like the Moon at a quarter full. He turned it on the Milky Way and beheld innumerable tiny stars.* From the given passage, Galileo made several telescope because
(a) he needed all of them to explore the heavens
(b) he wanted to compare the findings obtained from different telescopes
(c) the earlier one he made were not powerful enough
(d) only some of them could magnify the stars

7. *My father was passionate about two things: education and socialism. He was himself a born teacher. Indeed, he could never restrain himself from teaching and as a small boy I was frequently embarrassed by his desire to instruct everybody-people in railway carriages, for instance-thought I realised even then that it was an innocent desire, quite free from vanity. He was equally ready to receive instruction. Education, to men of his generation and temperament, was something it has largely ceased to be now-a-days. It was the great golden gateway to the enchanted realms of the mind.* The author wants us to know that his father
(a) was a school teacher
(b) was an educationist and socialist
(c) used to travel a lot
(d) loved teaching

8. *When Ibbotson returned from Pauri, I told him of the leopard's habit of going down the road between Rudraprayag and Golabraion on an average once in every five days. I convinced him that the only hope I now had of shooting the man-eater was by sitting over the road from ten nights, for, the leopard would be almost certain to use the road at least once during the period. Ibbotson agreed to my plan reluctantly, for I had already sat yp many nights and he was afraid that another ten nights on end would be too much for me.* Ibbotson was reluctant to agree to the narrator's plan because he was afraid that
(a) the leopard would kill him
(b) the narrator would become very tired
(c) the narrator would kill the leopard
(d) the leopard might not come

9. *It was bitterly cold night, and even at the far end of the bus, the East wind that raved along the street cut like a knife. The bus stopped, the two women and a man got in together and filled the vacant places. The younger woman was dressed in sealskin and carried one of those Pekinese dogs that women in sealskin like to carry in their laps. The conductor came in and took the fares. Then his eye rested with cold malice on the beady-eyed toy dog. I saw trouble brewing. This was the opportunity for which he had been waiting, and he intended to make the most of it.* Which of the following statements best describes the nature of the conductor?
(a) He was dutiful

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(b) He was a law-abiding person
(c) He likes dogs
(d) He was unfriendly and malicious

10. *For days I trudged from one property dealer to another, from one 'to-let' notice to another with the estimated advance money tucked safely in the inner lining of my handbag, but in vain. At one place, they needed a couple, at another a young man, and at another they wished to know my employment status. And I realised that I was a freak called the single woman and the job status nothing more than a freelance writer with hardly any assignments in hand, only dreams of making it someday. So, the dream-house remained far away, gradually turning into a fantasy.* Which of the following statements can be inferred from the above passage?
(a) People always let our their houses to well employed persons only
(b) People always let out their houses only to couples
(c) Single jobless women, find it difficult to rent a house
(d) Women always dream of a house

11. *To what extent, though, are modern farming methods sustainable? There is abundant evidence that a high price has to be paid to sustain the high rates of food production achieved by farmed monocultures. For e.g., they offer ideal conditions for the epidemic spread of diseases such as mastitis brucellosis and swine fever among, livestock and coccidiosis among poultry. Farmed animals are normally kept at densities far higher than their species would meet in nature with the result that disease transmission rates are magnified. In addition high rates of transmission between herds occur as animals are sold from one farming enterprise to another, and it is easy for the farmers themselves, with mud on their boots and their vehicles, to act as vector of pests and disease.* With reference to the passage, consider the following statements:
(i) The modern practices of farming are undesirable for developing countries.
(ii) Monoculture practices should be given up to eliminate disease transmission in animals.
Which of the statements given above is/are correct?
(a) Only 1 (b) Only 2 (c) Both 1 and 2 (d) Neither 1 nor 2

12. *Discussions on drug addiction should also be concerned with the vast majority of people who are not addicts. Their homes and lives are insecure because our narcotics law drive such people to crime. The drug addict is almost never dangerous when he is under the influence of drugs. What makes him dangerous is the desperate need for money to buy the next dose. Drugs are available only in an illegal black market. The costs are stupendous, and this is what drives the addicts to steal, rob and even kill.* With reference to the passage, consider the following statements: (i) Addiction to drugs is a criminal act. (ii) Drug addicts cannot be rehabilitated. Which of the statements given is/are correct?
(a) Only 1 (b) Only 2 (c) Both 1 and 2 (d) Neither 1 nor 2

13. *A little girl was learning a history lesson with her governess. All the morning she had been reading it over and hearing it explained by her governess, but no good came of either the reading or the teaching. The governess went over the lesson several times, explained the meaning, and for the last time, asked her pupil to read it over. After due time had been given, the girl was examined as to her knowledge of the lesson; but not a single answer could she give correctly. The governess loses patience with her, and threatened to punish her unless she could state where a certain treaty was signed.* With reference to the passage, consider the following statements:
(i) The governess taught the same lesson several times.
(ii) The governess wanted to complete her teaching work quickly.
Which of the statements given above is/are correct?
(a) Only 1 (b) Only 2 (c) Both 1 and 2 (d) Neither 1 nor 2

14. *As the tortoise tucks its feet and head inside the shell and will not come out even though you may break the shell into pieces, even so the character of the man who has control over his motives and organs, is unchangeably established. He controls his own inner forces and nothing can draw them*

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out against his will. By this continuous reflex of good thoughts and good impressions moving over the surface of the mind, the tendency to do good becomes strong, and in consequence, we are able to control the indriyas or sense organs. Which of the following can be inferred from the given passage?

(a) Man is slow-moving and slow-witted
(b) A man of character refuses to be influenced by outside compulsions against his will
(c) Man confines himself to a life of isolation
(d) Man cannot have a good character or strong will

15. *The sky was already full of rusting wings. But when Jean stepped into the still lustreless water, he seemed to be swimming in an indeterminate darkness until he saw the streaks of red and gold over the horizon. Then be suddenly swam back to land and clambered up the winding path to his house. After a great deal of panting he reached a little gate, pushed it open and climbed a stairway. The house above the world had its huge bay-windows through whoch one could see the horizon from one edge to the other. Here, no one complained of exhaustion. Everyone has his joy to conquer, every day.* Which of the following is/are indicated by the description in the passage?

1. Time before sunrise 2. Time after sunset 3. Clouds 4. Birds

(a) 2 and 3 (b) Only 2 (c) 2, 3 and 4 (d) 1 and 4

16. *A male Jackdaw's courtship behaviour is astonishingly human. All his movements are consciously strained and his proudly reared head and neck are permanently in a state of self-display. He provokes the other Jackdaws continually if the female Jackdaw is looking on and he purposefully becomes embroiled in conflicts with otherwise deeply respected superiors. Above all, he seeks to impress his loved one with the possession of a potential nesting site, from which he drives all other Jackdaws, irrespective of their rank.* Which of the following statements best sums up the meaning of the above passage?

(a) The courtship behaviour of birds
(b) The similarities between the courtship behaviour of birds and men
(c) The astonishing facts about the Jackdaw's love life
(d) The scientific study of the Jackdaw's life

17. *Young seekers after peace know that only equal trust shown to all the People of the Earth and not just to a few of them, can lead to the healing of the wounds that tear them apart and so it is essential never to humiliate the members of a nation whose leaders have committed inhuman acts.* Which of the following statements can be inferred from the given passage?

(a) Rigid nationalism alone can help peaceful co-existence
(b) Trusting all the people of the Earth may lead to serious problems
(c) Being cautious of others is a must to live in peace
(d) Concern for everyone irrespective of the race or country

18. *We shall go on to the end; we shall fight in France, we shall fight on the seas and ocean, we shall fight with growing confidence and strength in the air, we shall defend our island whatever the cost may be, we shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills. We shall never surrender, and even if this island or a large part of it were subjugated and starving, then our empire beyond the seas would carry on the struggle, until the New World steps forth to the rescue and the liberation of the Old.* Which of the following statement may be said to be correct based on the above passage?

(a) The speaker is encouraging his men for the conquest of France
(b) The speaker is aggressive and maniacal war-monger
(c) The speaker is not satisfied with the conquest of the island
(d) The speaker is a patriot urging the defence of his motherland

19. *Popular illusions about birds extend further than the use of the word 'egg-shape' that would suggest that all eggs are alike. For instance, there is the popular idea that owls hoot. Actually, only very few owls hoot and these include the common brown or tawny wood owl. The white barn*

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owl screeches; the little owl has a wailing cry; the long-eared owl barks; and the short-eared owl snorts! Another mistaken idea is that all ducks 'quack', because the common farmyard duck is a domesticated form of the common wild duck or mallard that quacks. Actually most wild ducks call with whistles. The main purpose of the passage is

(a) to describe the life of popular birds
(b) to show out incorrect ideas of bird life
(c) to show our perfect knowledge about birds
(d) to describe the calls of owl and ducks

20. *With the inevitable growth of specialisation I see the universities facing two great dangers. First, it is very easy to get so involved in the technical details of education that the object of education is lost. And secondly, in an effort to condition a university to the needs of its students and to the needs of the state it may lose its power to make or mould those students into responsible men, capable of thinking for themselves and capable of expressing the results of their thoughts to others.* It can be inferred from the given passage that

(a) the aim of education is specialisation
(b) the aim of education is to mould the youth to work for the state
(c) the aim of education is to make the youth capable of independent thought and expression
(d) the aim of education is to enable the youth to earn a comfortable living

21. *It is said that ideas are explosive and dangerous. To allow them unfettered freedom is, in fact, to invite disorder. But, to this position, there are at least two final answers. It is impossible to draw a line round dangerous ideas, and any attempt at their definition involves monstrous folly. If views, moreover, which imply disorder, are able to disturb the foundation of the state, there is something supremely wrong with the governance of the state. For disorder is not a habit of mankind. We cling so eagerly to our accustomed ways that, as even Burks insisted, popular violence is always the outcome of a deep popular sense of wrong.* Which of the following can be inferred from the given passage?

(a) It is unnecessary to define dangerous ideas
(b) Dangerous ideas are born out of the enjoyment of freedom
(c) A well-governed state is unaffected by dangerous ideas
(d) Dangerous ideas originate from man's preoccupation with politics

22. *What is to be the limit of forgiveness? It would probably have been allowed by many of the ancients that are unforgiving temper was not to be commended. They would have said, we are not to exact a penalty for every nice offence, we are to overlook some things, we are to be blind sometimes. But they would have said at the same time, we must be careful to keep our self-respect, and to be on a level with the world. On the whole, they would have said, it is the part of a man fully to requite to his friends their benefits and to his enemies their injuries.* Which of the following statements best sums up the meaning of the above passage?

(a) We must be forgiving in general
(b) We must forgive our friends
(c) There is no limit whatsoever to our duty to forgive
(d) We must always punish the wrong doer

23. *Once upon a time I went for a week's holiday in the Continent with an Indian friend. We both enjoyed ourselves and were sorry when the week was over, but on parting our behaviour was absolutely different. He was plunged in despair. He felt that because the holiday was over all happiness was over until the world ended. He could not express his sorrow woo much, but in me the Englishman came out strong. I could not see what there was to make a fuss about. It wasn't as if we were parting forever or dying. 'Buck up', I said, 'do buck up'. He refused to buck up, and I left him plunged in gloom.* What is the author's intention in the passage?

(a) To contrast the Indian character with the English character
(b) To show that an Indian is sorrowful
(c) To ridicule the Indian traditions
(d) To praise the Englishman

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24. *We should preserve nature to preserve life and beauty. A beautiful landscape, full of green vegetables, will not just attract our attention but will fill us with infinite satisfaction. Unfortunately, because of modernisation, much of nature is now yielding to towns, roads and industrial areas. In few places some Natural reserves are now being carved out to avert the danger of destroying Nature completely. Man will perish without Nature, so modern man should continue this struggle to save plants, which gives us oxygen, from extinction. Moreover, Nature is essential to man's health.* According to the passage, which of the following statement is correct?

(a) Beauty is only skin-deep
(b) Everything is beautiful in its natural state
(c) There is beauty in Nature
(d) Nature is a moral teacher

25. *The first day out we met our first rhino, two of them and I had the fright of my life. The pair had our scent before we spotted them and being had tempered beasts, they rushed towards where they thought we were. Now it just happened that we were about fifty yards to one side of where they expected to find us-which was just as well, for I must say I did not like their look. As they thundered past, we crouched low and let them go. It did not strike me as a good opportunity for rhino photography. Anyhow, I was much too frightened to have been able to hold the camera steady.* Based on the above passage, which of the following statement is correct?

(a) Rhinos rush to attack when they smell human scent
(b) Rhinos hide under the bushes at the sight of human beings
(c) When the author saw a rhino for the first time, he was excited
(d) The author could not take the photographs of the rhinos because he was too far away from rhinos

26. *Martin had many little tricks highly entertaining to his son. On an evening, returning from the market, he would buy a paper mask, the head of a hissing dragon. He would put it on and knock at the door. On opening the door, the boy would be terrified for a moment, but only for a moment, for he would soon remove it and the two would roll with laughter. Tom would, then, go out with the mast and knock at the door for his father to open. Martin has to act as if he was paralysed with fear.* Consider the following statements:

(i) Martin played his little tricks because he was very much interested in them.
(ii) It is a mask looking like the head of a dragon with its tongue hanging out.
(iii) The father and son rolled with laughter after the father removed the mask.

Which of the statements given above is/are correct?

(a) Only 1 (b) Only 3 (c) Both 2 and 3 (d) Both 1 and 2

27. What were the early ideas of men about the sky and the Earth? They naturally believed that the Earth was motionless, and they also supposed that it was flat. These two ideas do not surprise us. Children now-a-days think the same until they are taught differently. How were men to know that the earth was a ball circling round the Sun? They had no telescope for accurate observation. They had nor travelled round the world. In fact many parts of the world in those days were unexplored and unknown. They lived on a kind of flat plate, and that the sky with the Sun and the moon and the stars, was a kind of inverted bowl turning round above them. The Sun, the Moon and the stars were their lamps for day and night. Which of the following statements based on the above passage is correct?

(a) Unless children are taught differently they think that the Sun and the Moon are motionless
(b) The early ideas of man were wrong because man never had the scientific knowledge
(c) The early man believed that the telescope was accurate
(d) Seeing and believing are the main cause of the early man's wrong ideas

28. *Cozette could have been a pretty child, but she was thin and pale and her eyes were stained with weeping. She was dressed in her thin torn cotton dress and she shivered all the time. Here and there on her body were blue marks from the beatings that her mistress had given her. Her naked legs were red and rough. When she spoke, her voice trembled. Everything about the child, her looks, her behaviour, her speech, her silence, every small gesture she made, showed a terrible fear. She was so afraid that, even though she was wet through, she dared not go near the fire to*

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warm herself, but sat shivering in a corner of the room. Which of the following statement is correct based on the above passage?
(a) Cozette could not be a pretty child because she was scantily dressed
(b) Cozette's voice trembled because she was frightened
(c) Cozette's terrible fear is conveyed most vividly by the description of her tear-stained eyes
(d) The cause of Cozette's fear is explained by her pale appearance

29. *I came home from one vacation to find that my brother Ron had bought a dog while I was away. A big burly, choleric dog, he always acted as if he thought I wasn't one of the family. There was a slight advantage in being one of the family. For he didn't bite the family as often as he bit strangers. Mother used to send a box of candy every Christmas to the people he bit. The list finally contained forty or more names. Nobody could understand why we didn't get rid of the dog.* Based on the given passage, which of the following statement is correct?
(a) The dog was tiny and delicate
(b) The dog was sturdy and short-tempered
(c) The dog was huge and cool
(d) The dog was small and sweet

30. *Many doctors flatly refused to believe Jenner when he announced that he had found a preventive against smallpox. They declared vaccination to be a dangerous practise. But the dread of smallpox was in everybody's heart, and people flocked to Jenner to be vaccinated. The Latin word for cow is 'Vacca', it is the root from which the word vaccination was formed. Some of the 'Vacca' used by Jenner were not pure and some harms were done; but when supplies of pure vaccine were available, the practice of vaccinating spread all over England and from England to other countries. We hardly hear of outbreaks of smallpox now.* Which of the following statements best sums up the meaning of the above passage?
(a) How smallpox may be treated
(b) How vaccines were malfunctioned in England
(c) The dangers of vaccination especially for children
(d) The gradual acceptance of vaccination as a preventive against smallpox

31. *One of the most serious problems confronting our country is that of a fast-growing population. In fact, it is at the root of many other problems. At the moment, thanks to planning, we are able to produce food and cloth sufficient for our people and even in some excess. But if the population continues to grow at this rate, it will not be long before the surplus turns into a bare minimum and even a deficit. The position in regard to accommodation is even now far from satisfactory in spite of our efforts.* Based on the above passage which of the following statements is correct?
(a) The present satisfactory position in regard to food and cloth is due to our economic planning
(b) If the population of India continues to increase at this rate, the situation in regard to food and cloth is likely to improve
(c) The situation in respect of accommodation is the result of total neglect
(d) At present Indians have abundance of cloth and accommodation

32. *One day we were becalmed among a group of small islands, most of which appeared to be uninhabited. As soon as we were in want of fresh water, the captain sent the boat ashore to bring off a cask or two. But we were mistaken in thinking there were no natives, for scarcely had we drawn near to the shore 'when a band of savages rushed out of the bush and assembled on the beach, brandishing their clubs and spears in a threatening manner.* Consider the following statements based on the above passage:
(i) The captain sent the boat to the shore to fetch some water
(ii) The savages brandished their spears in order to frighten the crew
(iii) The inhabitants of the islands were cruel people
Which of the above statements is/are correct?
(a) Only (i) (b) Only (iii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

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33. *One day an army group won a land battle against the enemy. The commander feared that the enemy's powerful air force might bomb his camp that night in revenge. So he ordered all lights to be put out at 7:00 PM. At midnight the commander went round inspecting the camp. Seeing a light in a tent, he entered it. His son, an officer under him, was writing a letter. The son explained that he was writing to his mother about his brave deeds in battle. The commander told his son to add to his letter that by the time his mother received the letter he would have been shot dead for indiscipline.* Consider the following statements based on the above passage:

(i) The commander went round the camp at midnight because he was too tired from the day's battle to go to sleep

(ii) The commander entered his son's tent because he had to punish any soldier who disobeyed his order

(iii) The son was writing a letter because he was eager to tell his mother about his own deeds

Which of the above statements is/are correct?

(a) Only (i) (b) Only (iii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

34. *'Punctuality' said Louis XIV, 'is the politeness of kings'. It is the mark of a gentleman, and 'the necessity of men in business'. Washington once took his Secretary to task for being late. The Secretary laid the blame upon his watch. Washington retorted. "Then, sir, either you must get a new watch or I must get a new Secretary". Much of our success in life depends upon our being punctual in our undertakings and appointments. Hence the necessity of steadily cultivating this virtue in our daily life.* Which of the following statements best sums up the meaning of the above passage?

(a) Punctuality is a virtue which is appreciated by kings

(b) Punctuality is a virtue which is difficult to cultivate

(c) Punctuality is a virtue which is necessary for success in life

(d) Punctuality is a virtue which can make daily life pleasant

35. *Nowadays we are amused by professionals. Why listen to your friends singing when you can hear the great singers of the world on the gramophone or the radio? Why read even a detective story if you can see one at the cinema, and why play football with players who are not very good when you can go, by train or car, to see some of the best players in your country playing an important match; or, if you have a television set, just sit comfortably at home and watch the same without the trouble of going outside?* The primary criticism of the author about his contemporaries is that

(a) they are unprofessional and unskilled

(b) they want to enjoy all the good things of life

(c) they waste all their time with amusements

(d) they have a lazy and mechanical attitude towards amusements

36. *A village must have some trade; and this village has always been full of virility and power. Obscure and happy, its splendid energies had found employment in wresting a livelihood out of the earth, whence had come a certain dignity, and kindliness, and love for other men. Civilization did not relax these energies, but it had diverted them; and all the special qualities, which might have helped to heal the world, had been destroyed. The family affection, the affection for the commune, the sane pastoral virtues – all had perished. No villain had done this thing: it was the work of ladies and gentlemen who were rich and often clever.* Based on the above passage consider the following statements:

(i) Village life is praised by the author because it helps villagers to achieve material prosperity

(ii) Civilization mainly destroys family affection and pastoral virtues

(iii) The tone used by the author in the last sentence of the passage is Ironic

Which of the above statements is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

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37. *The art of growing old is one which the passage of time has forced upon my attention. Psychologically there are two dangers to be guarded against in old age. One of these is undue absorption in the past. It does not do to live in memories, in regrets for the good old days. One's thoughts must be directed to the future. This is not always easy; one's past is a gradually increasing weight. The other thing to be avoided is clinging to youth on the hope of sucking vigour from its vitality.* The passage deals with the process of growing old. What does it describe?

(a) The decay of the senses in old age
(b) The psychological problems of old men
(c) The desire in man to grow old
(d) An old man's ability to recollect his past

38. *In our approach to-life, be it pragmatic or otherwise, a basic fact that confronts us squarely and unmistakably is the desire for peace, security and happiness. Different forms of life at different levels of existence make up the teeming denizens of this earth of ours. And, no matter whether they belong to the higher groups such as human beings or to the lower groups such as animals, all beings primarily seek peace, comfort and security. Life is as dear to a mute creature as it is to a man. Even the lowliest insect strives for protection against dangers that threaten its life. Just as each one of us wants to live and not to die, so do all other creatures.* The author's main point is that

(a) different forms of life are found on earth
(b) different levels of existence are possible in nature
(c) peace and security are the chief goals of all living beings
(d) even the weakest creature struggles to preserve its life

39. *Ah! whatever could be said was said. All held him guilty. Even his own mother who claimed to understand him the best. All had betrayed him in his hour of need. Yet, there he was, still with a sparkling hope and knew that the truth must prevail. In the cold, dark and damp cell he never for a moment lost faith in God and goodness and was waiting anxiously for an angel to come, plead non guilty for him and free him of his miseries.* Based on the given passage, consider the following statements:

(i) Whatever others said about him, he never lost faith in goodness
(ii) In the dark dungeon he always waited for the verdict freeing him of his miseries
(iii) The truth must prevail means angel will reveal truth

Which of the above statements is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

40. *Once while travelling by the local bus, I got a seat beside a very strange man. He seemed interested in every passenger aboard. He would stare at a person, scribble some odd mathematical notations on his long notebook and then move on to the next. Being quite interested in what he was doing I asked him what all those notations meant and then came the startling reply. He saw a man's face not as a single unit but as thousands of squares put together. He was in fact a statistical expert and a budding artist learning the art of graphics.* From the given passage we conclude that

(a) The author is very inquisitive
(b) The author tries to poke his nose in other people's business
(c) The author is interested in mathematical notations
(d) The author wants to talk to, fellow passengers in the bus

41. *One December night, a family had gathered around their fireside and piled it high with wood gathered from mountain streams and ruins of great trees that had come falling down the mountain sides. The lire roared and brightened the room with its light. The faces of the father and mother had a quiet gladness; the children laughed; the oldest daughter was the picture of happiness at seventeen; and the aged grandmother who-sat sewing in the warmest place was the picture of happiness grown old.* Base on the given passage, consider the following statements:

(i) The firewood had been stolen
(ii) The parents looked cheerful

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(iii) The oldest daughter looked mournful

Which of the above statements is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

42. *The unpleasant feeling passed and she glanced guardedly up at him. He was walking unmarked in moonlight, innocent of her reaction to him. She felt then - this thought had come to her before - that there might be more to him than she had imagined. She felt ashamed she had ^ever thanked him for the help he had given her father.* Which of the following statements is correct?

(a) She glanced at him when she was sure that she was not being noticed
(b) She was ashamed because she had never thanked him for his help to her father
(c) Her unpleasant feeling passed when he did not take any notice of her
(d) She was ashamed because she was spying on him

43. *He dropped off to sleep. The cigarette slipped out of his mouth and burnt a great black hole in his only shirt. The smart of the burn awoke him, and he got up, cursing under his breath, and fumbled in the dark for a needle in order to sew up the hole. Otherwise his wife would see it in the morning and would nag away at him for a couple of hours. But he could not find a needle. He fell asleep again.* Which one of the following statements best sums up the meaning of the above passage?

(a) The man is extremely upset to find the shirt burnt and frantically tries to repair the damage
(b) The hole in the shirt and the wife's anticipated nagging are minor problems, the greater one is that the man cannot find a needle
(c) Neither the shirt hole nor the nagging nor the lack of a needle is of great consequence
(d) The man is terrified of his wife and dreads her discovering the burnt shirt

44. Scientists show that there is a curious relationship between a lion's life span and the pattern of spots on each side of its face. Each spot is associated with the root of a whisker, and the pattern of spots is as characteristic of an individual lion is a finger print of a person. But the placement varies between the two sides of the face. Males with a greater degree of symmetry tend to die younger than their more evenly envisaged colleagues. Thus can a male's life be read in his face it is his autobiography. Based on the above passage which of the following statements is not correct?

(a) The variation between the patterns is a pointer to the lion's longevity
(b) There is hardly any variation between the patterns on the two sides of a lion's face
(c) The pattern of spots is characteristics of each individual lion
(d) The relationship between the pattern of spots and the life span of a lion is something strange

45. *All attempts to detect oxygen in the atmosphere of Mars have been unsuccessful, and it can be concluded that the amount of oxygen is not more than one-thousandth part of the amount in the Earth's atmosphere. Indirect evidence of oxygen is provided by the ruddy colour of Mars, which is unique among the heavenly bodies. This red colour is suggestive of rocks that have been completely oxidized and it may be contrasted with the grey or brownish colour of the rocks on the Moon, which have remained un-oxidised because of the absence of oxygen. It appears probable that Mars may be a planet where the weathering of rocks followed by their oxidation, has resulted in the almost complete depletion of oxygen from the atmosphere.* Which of the following statements best is correct based on the above passage?

(a) The amount of oxygen in Mars has remained constant
(b) Once there was more oxygen in the atmosphere of Mars than there is now
(c) At one time Mars was swept by fire, which turned the rocks into a reddish colour
(d) Severe storms caused the weathering of rocks

46. *Our greatest need, after water is sodium chloride, or common salt. We need it for a very curious reason. It is not found in most cells of our body, or in most plant cells. They contain potash salts and there are plenty of these in every kind of food. But it is found in our blood. Our horses and cows are often short of salt. That is why they lick each other in summer. Men who sweat a good*

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deal feel an instinctive need of salt. Miners in deep and hot mines eat far more bacon than the average of the population, and some of them put a little salt in the drinking water. If they run very short of salt they may get cramps in the limbs or stomach. The same applies to other workers who sweat very greatly, such as ship's firemen. The firemen of Scandinavian ships eat more salted fish and salted meat than those of British ships and are therefore less affected. Based on the above passage, consider the following statements: (i) Men who sweat less are in dire need of salt; (ii) Shortage of salt can lead to cramps in the stomach or limbs. Which of the statement(s) given above is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

47. *For months they had barely kept themselves alive in a sort of shelter they built with their own hands amidst the rubble. Then the German Elite Guard established headquarters in Verona and for three dreadful years ruled the city with ruthless severity. The boys grew to hate those harsh, unwanted masters and when the resistance movement began secretly to form, they were among the first to join. It was not matter of 'playing war'. Their extreme youth and insignificant size, added to an intimate knowledge of the neighbouring hills, made them immensely valuable.* Based on the given passage it can be inferred that

(a) the city was ravaged by a war
(b) the people were celebrating the liberation of the city
(c) the people of the city had faced oppression
(d) the young people hated their employers

48. *A local man, staying on the top floor of an old wooden house, was awakened at midnight by a fire. Losing his way in a smoke-filled passage, he missed the stairway and went into another room. He picked up a bundle to protect his face from the fire and immediately fell through the floor below where he managed to escape through a clear doorway. The 'bundle' proved to be the baby of the Mayor's wife. The 'hero' was congratulated by all.* Based on the given passage, consider the following statements:

(i) The man missed the stairway because he did not know where exactly it was
(ii) The man picked up the bundle because he thought it would keep away the fire from burning his face
(iii) The man was called a hero because he saved a life

Which of the statement(s) given above is/are correct?

(a) Only (ii) (b) Only (iii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

49. *Stress is a twentieth century illness. This is so because of the hectic pace of life and the deadly rate-race around us. Different people react to stress in varied ways. Irritation, worry, depression are all signs of stress. It affects everyone from children to old people. Inability to cope with it results in destructive tendencies. Of course, there is hope, because though some people crack up, a lot of others don't. Hobbies, friends, music can help you reduce it.* It can be inferred from the given passage that, to cope with stress is to

(a) avoid getting irritated (b) fight destructive tendencies
(c) avoid all work and hectic activity (d) cultivate a few hobbies

50. *For generations Charlie Chaplin has been a source of amusement, this hero has to struggle a lot with adversaries which are human as well as non-human. For example, this duel with the revolving door that always turns him out into the streets or the rocking chair from which, once seated, he can't escape. This struggle has a deeper meaning. Not only people but even objects defeat him because they are superior to him. His humanity can't adapt itself to their mechanical nature. That is why we find him so close to us.* Which of the following statement cannot be inferred from the given passage?

(a) Chaplin's hero represent the common man
(b) Chaplin cannot adjust himself to others because of their inimical behaviours
(c) Chaplin's films represent the struggle between a sane person and a mad world

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(d) 'The revolving door' and 'the rocking chair' in the passage are illustrations of forces which curtail our freedom in society

51. *Gandhi has sound economic and cultural reasons for encouraging the revival of cottage industries, but he does not counsel a fanatical repudiation of all modern progress. Machinery, trains, automobiles and the telegraph have played important roles in his colossal life. Fifty years of public service, in prison and out, wrestling with practical details and harsh realities in the political world, have only increased his balance, open-mindedness sanity, and humorous appreciation of the quaint human spectacle.* Based on the given passage, consider the following statements:

(i) Gandhi though that machinery and various other modern scientific inventions thwarted all his plans to encourage cottage industries

(ii) Long spells of prison life and struggle for India's freedom affected Gandhi's way of thinking

Which of the above statement is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

52. *Human ways of life have steadily changed. About ten thousand years ago, man lived entirely by hunting. A settled civilized life began only when agriculture was discovered. From that time to this, civilization has always been changing. Ancient Egypt-Greece-the Roman Empire-the Dark Ages and the Middle Ages-the Renaissance-the age of modern science and of modern nations-one has succeeded the other, and history has never stood still. Even if we try to do nothing, we cannot prevent change.* The subject of the given passage is

(a) the revolutionary process of the growth of mankind
(b) the biological evolution of mankind
(c) the revolutionary process of growth of civilization
(d) the dialectic process of civilization

53. *A hundred year ago people wondered why anyone should be concerned about the tiger. The tiger population was quite large, and the thick and widespread forest cover provided a natural habitat for the animal. But over the years, poaching and increasing encroachment on the tiger's habitat have caused the tiger population to decline alarmingly in India. To ensure its survival, the Indian Government has placed the tiger in the endangered species list, and also declared it as India's national animal.* Based on the above passage, which of the following statement is correct?

(a) A hundred years ago, people were very much concerned about the tiger
(b) The population of the tiger was large at that time because people left them undisturbed
(c) The tiger population has come down today because of the decline health of tigers
(d) The government has placed the tiger on the endangered species list to ensure that tigers do not become extinct

54. *Our busy and absent-minded father would never worry about us children; our mother did worry. Yet she allowed us to go off into the hills immediately after breakfast, and did not complain when we came back long after supper-time. Though she had a bad head for heights, she never restrained us from climbing in dangerous places; and we never got hurt. Having a bad head for heights myself, I trained myself deliberately and painfully to overcome it.* Which of the following statements best express the main thought in this passage?

(a) The indifference of the parents led to the children's growing up wild
(b) The mother trusted her children and in spite of normal anxiety, gave them freedom to explore the countryside and they came to no harm
(c) His mother's fear of heights spurred on the author to conquer the same fear in himself
(d) The mother never complained when her children were climbing

55. *As time passed, signs of age and weariness started showing in Galatea's appearance. This made Pygmalion very unhappy for he believed that beautiful creations must remain permanent. Pygmalion foresaw her inevitable fate and when night came he took his chisel and struck her bosom a blow and lo! Galatea returned to the original marble. All that night he chiselled. Next*

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morning he saw something quite different compared to the original. The lip had lost their great beauty; the eyes told of the grief of living; the whole body was bent towards the earth. The whole night, in the dark, he had been sculpting the very face of grief. And Pygmalion wept. Based on the given passage, which of the following statement is correct?

(a) Galatea's face started showing signs of satisfaction
(b) Pygmalion believed like a true artist that perfect beauty was impossible
(c) Pygmalion re-chiselled Galatea's statue to make it more beautiful
(d) Pygmalion wept after recasting the statue because he had realized that human life was a drama of pain

56. *Work itself is a very important factor in motivating a person. A person tends to perform a task more enthusiastically if that work affords more satisfaction than the other work. A person's satisfaction out of work is more if it more need-satisfying. A man seeks something from work and if he gets more satisfaction from a particular work he will be prone to do that work better or harder. There are incentives for work; these can be financial or non-financial. People like missionaries and some scientists do not work basically for material gains as such. A person wants to do a work which is personally meaningful.* Which of the following statement can be inferred from the given passage?

(a) Among the several factors that motivates a person, work is an important one
(b) Work is the most important factor by which a person is motivated
(c) Work is the least important factor that motivates a person
(d) Nothing can motivate a person who does not have some permanent work

57. *I once saw a tigress stalking a month old kid. The ground was very open and the kid saw the tigress while she was still some distance away and started bleating, whereon the tigress gave up her stalk and walked straight up to it. When the tigress had approached to within a few yards, the kid went forward to meet her, and on reaching the tigress stretched out its neck and put up its head to smell her. For the duration of a few heart beats the month-old kid and the queen of the forest stood nose to nose, and then the queen turned and walked off in the direction from which she had come.* Based on the given passage, consider the following statements:

(i) The tigress walked straight up to the kid because she was sure of her victim
(ii) The kid's behaviour indicates that it was familiar with the sight of tigress
(iii) The expression 'for the duration of a few heart beats' suggests the anxiety of the watcher

Which of the above statement is/are correct?

(a) Only (i) (b) Both (i) and (ii) (c) Both (i) and (iii) (d) Both (ii) nor (iii)

58. *The door led to the back of a steep tier of narrow wooden benches wising from the lecturer's desk like a football stand. Behind the desk were three large blackboards screwed to the walls, which were otherwise panelled with stained perpendicular planks. The roof was lost in a criss-cross of thin iron girders through which half a dozen electric globes were suspended to supplement the thin light that filtered through the windows under the eaves.* The given passage describes

(a) a stadium (b) a lecture theatre (c) an operation theatre (d) a cinema hall

59. *Patriotism is easy enough during war. For one thing, people become actively conscious of their country when it is threatened. For another, since everyone or nearly everyone feels it, there is a strong collective emotion flowing through the country. But when the war is over, the country recedes from the consciousness, and it is rarely even at the back of the mind. The question, "Am I doing any good to the country?" doesn't occur to the mind; and even the question, "Is what I am doing good or bad for the country?" occurs only rarely. A limited patriotism is better than none, but it is not enough.* It can be inferred from the given passage that, when the threat of war is over

(a) people tend to become totally unmindful of national interests
(b) there is no need for people to be interested in others' welfare
(c) people do not consider it necessary to serve the country
(d) people are generally anxious to serve the country

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60. *Most people lead the lives that circumstances have thrust upon them. But Wilson had boldly taken the course of his life into his own hands. At 35, he had quit his job to lead a pleasant life on an exotic island with just enough money to last for twenty five years. Once, fifteen years after he had been on the island, I happened to meet him and enquired about his financial situation. He said, "It will carry me on till I am sixty." "But one cannot be sure of dying at sixty", I said. "Well..." he replied, "it depends on oneself, doesn't it"?* Based on the given passage it can be inferred that most people

(a) do not allow circumstances to affect their lives
(b) have fatalistic attitude towards life
(c) do not know how to cope with their solution
(d) do nothing to change the condition they live in

61. *Most of you probably did not see Mohan at close quarters. He had amazing qualities. One of these qualities was that he managed to draw out the good in another person. The other person may have had plenty of evil in him. But he somehow spotted the good and laid emphasis on the good. The result was that the poor man had to try to be good. He could not help it. He would feel ashamed when he did something wrong.* Based on the given passage, consider the following statements:

(i) The author assumes that most of us are not well-acquainted with Mohan's powers
(ii) One of Mohan's greatest qualities was that he could discover the good in another man

Which of the above statements is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

62. *If we think about the men and women whose judgement on practical affairs and on conduct we respect, we should certainly agree that academic education did not seem to be very important in their being. We should say that some of them were learned and others not, some rich, others poor. They had no special training or accomplishment. That is why we contrast the one-sidedness of the expert with the good sense or common sense of an ordinary man and why democrats think that the proposals of the expert should be improved by the ordinary man.* Which of the following option is correct based on the given passage?

(a) The use of the epithet 'academic' is referential
(b) Second judgement derives from specialization
(c) The inference can be drawn by the author in this passage is ambiguous
(d) The observation that men and women of (sound) judgement have no special training is a sweeping generation

63. *The shy Mr Smith was regarded as a kind of luck-bringer among the miners, who look care of him, did all he gently asked of them, built his house and spent hours of their free time assisting him. When in a sentimental mood he first wrote about miners. Smith described them as large, muscular men; when he met them working underground and unclothed, he was struck by the slights of their build. They were slim and tough, of the staff from which swift footballers were made. On big holidays they dressed smartly, but the comradeship among them was such that a dressy young man did not mind being seen with one who neither wore nor owned a collar.* Based on the given passage, it can be inferred that the miners regarded Smith

(a) with awe, as someone very powerful
(b) with admiration, as an expert in mining
(c) impatiently, as a bore
(d) with superstition and affection, as a source of good fortune

64. *But I did not want to shoot the elephant. I watched him beating his bunch of grass against his knees, with that preoccupied grandmotherly air that elephants have. It seemed to me that it would be murder to shoot him. I had never shot an elephant and never warned to. (Somehow it always seems worse to kill a large animal.) Besides, there was the beast's owner to be considered. But I had got to act quickly. I turned to some experienced-looking Burmans who had been there when we arrived, and asked them how the elephant had been behaving. They all said The same thing:*

he took no notice of you if you left him alone, but he might charge if you went too close to him. Based on the given passage, consider the following statement:

(i) The author did not want to shoot the elephant because he did not find the elephant to be ferocious

(ii) It appears that the author was a confused and worried man

Which of the above statements is/are correct?

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

65. *For nearly twenty years 1 taught boys, lovingly and was being loved in return. When, after twenty-eight years of political work, 1 returned to education, 1 might have confined myself to administrate side, but took part in the actual instruction. This I did because I found happiness in It, Modern conditions do not tolerate caste and its monopolies and the high calling of the educator is open to all.* It can be inferred from the given passage that the author left teaching after twenty years because

(a) he was dissatisfied with teaching (b) he wanted to take part in political activities

(c) he wanted to become administrator (d) he was busy with family and domestic affairs

3.2 Ordering of Sentences

Exercise 3.2

In the following questions, the first and the last sentence of the passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4, and 5. These 4 parts are not arranged in proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given options.

1. **Example [GA-2015 (2 mark)]:**

1. On Diwali, the family rises early in the morning.
2. The whole family, including the young and the old enjoy doing this.
3. Children let off fireworks later in the night with their friends.
4. At sunset, the lamps are lit and the family performs various rituals.
5. Father, mother, and children visit relatives and exchange gifts and sweets
6. Houses look so pretty with lighted lamps all around.

The proper sequence should be (a) 2, 5, 3, 4 (b) 5, 2, 4, 3 (c) 3, 5, 4, 2 (d) 4, 5, 2, 3

2.

1. The lions used to be widely distributed in Africa and Asia.
2. There are special forest zones set aside for wildlife in various countries.
3. Indiscriminate killing by hunters has been the cause of this drastic fall in their numbers.
4. Today they are a relatively rare species.
5. If the species survives at all, it will be only in national parks.
6. No hunting is permitted in such reserved areas.

The proper sequence should be (a) 4, 5, 3, 2 (b) 5, 3, 4, 2 (c) 4, 3, 5, 2 (d) 5, 4, 2, 3

3.

1. What Martin Luther King, the peaceful warrior and his followers suffered, it is very difficult to describe.
2. The police used fire hoses and .ferocious dogs to rout them.
3. The law courts sent them to solitary confinement where not a ray of the sun entered.
4. They were abused and stoned by the mob, slapped and kicked by the police.
5. They suffered and tolerated all this without ever lifting a hand in self-defence.
6. For they had taken an oath to 'refrain from the violence of the fist, tongue or heart'.

The proper sequence should be (a) 5, 4, 3, 2 (b) 4, 2, 3, 5 (c) 2, 4, 5, 3 (d) 3, 4, 5, 2

4.

1. There were no finger prints anywhere.
2. First of all it was impossible even for a child to enter through the hole in the roof.
3. When the investigators tried to reconstruct the crime, they came up against facts.
4. Moreover, when the detectives tried to push a silver vase, it was found to be double the size of the hole.
5. Again, the size of the hole was examined by the experts who said that nothing had been passed through it.

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	6. These conclusions made the detectives think that it was a fake theft. The proper sequence should be (a) 2, 3, 4, 5 (b) 3, 2, 4, 5 (c) 5, 3, 4, 2 (d) 3, 4, 5, 2
5.	1. Great quantities of animal oil come from whales. 2. It produces a great quantity of oil which can be made into food for human consumption. 3. These enormous creatures of the sea are the largest remaining animals in the world. 4. When the whale is killed, the blubber is stripped off and boiled down. 5. To protect the whales from the cold of the Arctic seas, nature has provided it with a thick covering of fat called blubber. 6. A few other creatures also yield oil. The proper sequence should be (a) 2, 5, 4, 3 (b) 3, 5, 4, 2 (c) 2, 4, 3, 5 (d) 4, 2, 3, 5
6.	1. We who live in the present day world are proud to call ourselves civilized. 2. But let us search our hearts and ask ourselves, 'Has science solved our problem?' 3. Is it because we live and dress better than our forefathers? 4. Frankly speaking, the answer is 'No'. 5. Of course, we have the advantages of the inventions of science which our ancestors had never known. 6. In fact science has added to our worries. The proper sequence should be (a) 2, 3, 4, 5 (b) 3, 5, 2, 4 (c) 2, 4, 5, 3 (d) 5, 2, 4, 3
7.	1. No daily paper has ever found its way into this village. 2. These travellers come from distant places. 3. On their return journey they have news from the hills. 4. The only news the inhabitants get is from travellers. 5. On their way into the hills they bring news from distant plains and cities of India. 6. They carry this with them to the trading centres in the plains and cities. The proper sequence should be (a) 2, 3, 5, 4 (b) 4, 2, 5, 3 (c) 3, 5, 2, 4 (d) 4, 3, 2, 5
8.	1. A stag was drinking water at a pool. 2. He was admiring his shadow in the water. 3. All of a sudden some hunters came to the pool. 4. From what he saw, he liked his horns, but he was rather unhappy about his legs. 5. His legs helped him in getting away from the hunters, but his horns were caught in a bush. 6. He was thus caught by the hunters. The proper sequence should be (a) 3, 2, 5, 4 (b) 2, 3, 4, 5 (c) 2, 4, 3, 5 (d) 4, 2, 3, 5
9.	1. The earth was initially very hot and without an atmosphere. 2. The atmosphere came from the emission of gases from the rocks. 3. Because it contained no oxygen. 4. In the course of time it cooled and acquired an atmosphere. 5. This early atmosphere was not one in which we could have survived. 6. But it contained a lot of other gases that are poisonous to us. The proper sequence should be (a) 4, 2, 5, 3 (b) 2, 5, 4, 3 (c) 5, 2, 3, 4 (d) 3, 4, 2, 5
10.	1. When Galileo was young, people believed that the earth was the centre of the Universe. 2. But Galileo began to argue that it was not so. 3. This belief was supported by the State and the Church. 4. He said that the Earth and other planets moved round the sun. 5. He was imprisoned for voicing this unorthodox view. 6. But time has proved that Galileo's view was right. The proper sequence should be (a) 2, 3, 4, 5 (b) 2, 5, 4, 3 (c) 3, 2, 5, 4 (d) 3, 2, 4, 5
11.	1. In 1739, Nadir Shah, the mighty king of Iran, invaded India. 2. After a stay of two months, Nadir Shah went back to Iran. 3. He defeated the Mughal army in the battle at Karnal. 4. He took with him immense wealth as well as the Koh-i-noor diamond. 5. This was followed by the cruel massacre and reckless plunder of Delhi. 6. Another trophy he took with him was the Peacock Throne built by Shahjahan. The proper sequence should be (a) 3, 5, 2, 4 (b) 4, 3, 2, 5 (c) 2, 4, 3, 5 (d) 5, 2, 4, 3
12.	1. It was a very pleasant walk along the banks of the river.

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2. The buffalo had huge horns.
3. A kind of unknown calm and peace seemed to slide into my soul.
4. What delighted me most was the sight of a little boy sitting on the last Buffalo in the herd.
5. I saw a herd of buffaloes swimming across the river.
6. It charmed me beyond measure.

The proper sequence should be (a) 5, 4, 2, 3 (b) 2, 3, 4, 5 (c) 3, 5, 4, 2 (d) 4, 2, 3, 5

13.
1. The detective walked into the dark room alone.
2. It was later that he found the gun lying under a chair.
3. First he felt for the switch and turned on the light.
4. The furniture was smashed and the curtains torn.
5. At once he saw the disorder and confusion in the room.
6. He carefully picked up the gun making sure not to smudge the fingerprints

The proper sequence should be (a) 5, 3, 2, 4 (b) 2, 3, 4, 5 (c) 3, 5, 4, 2 (d) 4, 2, 5, 3

14.
1. Last night I was very tired and dropped off to sleep.
2. I thought I heard somebody move outside.
3. All of a sudden, a slight noise disturbed my sleep.
4. I got out of bed quietly and peeped out of the window.
5. I was frightened.
6. A goat was chewing up my rose plants.

The proper sequence should be (a) 3, 2, 4, 5 (b) 3, 5, 2, 4 (c) 5, 2, 3, 4 (d) 4, 5, 2, 3

15.
1. The train was running fast and the next station was nearly an hour ahead.
2. The children were pestering their aunt with embarrassing questions.
3. The occupants of the first carriage among others were a tall girl, a little girl and a little boy.
4. Luckily an ice cream vendor came to the rescue of the aunt.
5. Their aunt was occupying a comer seat.
6. She bought four cups of ice cream and all of them became busy with eating.

The proper sequence should be (a) 3, 5, 2, 4 (b) 2, 3, 4, 5 (c) 4, 2, 3, 5 (d) 5, 4, 3, 2

16.
1. My friend Todd owes me a dollar.
2. Whenever I meet him, he does not show any indication that he owes me a dollar.
3. My dollar has gone out of his mind.
4. Thus he meets me in the same frank friendly way as always.
5. He has owed it to me for twelve months, and 1 fear there is little prospect of his ever returning it.
6. I see that I shall never get it back.

The proper sequence should be (a) 4, 5, 2, 3 (b) 5, 3, 2, 4 (c) 5, 2, 4, 3 (d) 4, 3, 5, 2

17.
1. I searched for my friend all day.
2. Although I was weary and hungry, I was not discouraged.
3. I crept in and lay on the ground with my bag for a pillow.
4. When, midnight came I felt that I could not walk much further.
5. At last I came to a place where the pavement was raised and had a hollow underneath.
6. When I woke up the Sun was already above the horizon.

The proper sequence should be (a) 2, 4, 5, 3 (b) 2, 5, 3, 4 (c) 4, 2, 5, 3 (d) 5, 4, 3, 2

18.
1. Mr Johnson looked at his watch.
2. He was late as usual, so he did not have time for breakfast.
3. Then he washed and dressed.
4. He ran all the way to the station and he arrived there just in time for the train.
5. It was half past seven and h<; got out of bed quickly.
6. He always says to his friends at the office: 'It is nice to have breakfast in the morning, but it is nicer than to lie in bed.'

The proper sequence should be (a) 2, 5, 3, 4 (b) 4, 5, 3, 2 (c) 5, 4, 3, 2 (d) 5, 3, 2, 4

19.
1. A boy tried to discover how wasps find their way home.
2. He carried them two miles away and let them go.
3. First, he marked each of a number of wasps with a white spot.
4. He then put them into a paper box.

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5. To do this he carried out a test on them.
6. These wasps flew straight home.

The proper sequence should be (a) 2, 5, 3, 4 (b) 5, 4, 3, 2 (c) 5, 3, 4, 2 (d) 3, 2, 5, 4

20.
1. Rivers have played a great role in our lives.
2. It is famous as the Indus valley civilization.
3. Communication and trade depended on the rivers for centuries.
4. Who does not know that the very term India originated from Indus?
5. One of the earliest civilizations of the world flourished on the river Sindhu.
6. That was how Sindhu was pronounced by some foreigners.

The proper sequence should be (a) 5, 4, 3, 2 (b) 4, 5, 2, 3 (c) 3, 5, 2, 4 (d) 2, 4, 5, 3

21.
1. The next day Hiralal woke early.
2. Then he began to take out the bags containing the silver coins and the currency notes.
3. Three of the bags were empty.
4. After washing his face and hands he went back to his bedroom.
5. Suddenly his heart seemed to stop beating.
6. He could find nothing inside them except two letters.

The proper sequence should be (a) 3, 5, 2, 4 (b) 4, 2, 5, 3 (c) 2, 3, 4, 5 (d) 5, 2, 3, 4

22.
1. My friend had a dog.
2. He was very much upset.
3. Two days later it returned home.
4. Its right ear had been torn off.
5. One day he could not find the dog anywhere.
6. He took it to the veterinary hospital.

The proper sequence should be (a) 4, 2, 5, 3 (b) 5, 2, 3, 4 (c) 2, 5, 3, 4 (d) 5, 3, 4, 2

23.
1. A water tap is a device for turning on and off a flow of water.
2. The metal parts of a water tap are usually made of brass because brass resists' corrosion.
3. The other part is a washer which is fixed to the bottom of the rod.
4. One is a rod with a handle on the top.
5. It has two important parts.
6. The washer is made of a flexible material such as rubber or plastic.

The proper sequence should be (a) 5, 4, 3, 2 (b) 2, 3, 4, 5 (c) 2, 3, 5, 4 (d) 2, 4, 5, 3

24.
1. Albert Edward did very well.
2. He started looking for a place to open the new shop.
3. He started his shop with great enthusiasm.
4. He did so well that he began to think of opening another shop.
5. One fine morning he found it on a nearby street.
6. He then appointed a manager to take care of it.

The proper sequence should be (a) 2, 3, 4, 5 (b) 4, 5, 2, 3 (c) 2, 5, 4, 3 (d) 4, 2, 5, 3

25.
1. Why do birds migrate in spite of the heavy loss of life on the way?
2. But birds also migrate during summer.
3. Primarily they migrate during the summer.
4. Also they cannot endure the summer heat.
5. And the main reason now is not hunger but availability of the nesting sites.
6. The migration of birds thus is a fascinating study, indeed.

The proper sequence should be (a) 3, 2, 5, 4 (b) 2, 3, 4, 5 (c) 4, 5, 2, 3 (d) 3, 4, 2, 5

26.
1. I was only 12 years of age then.
2. But this was not enough even .to buy comics or toys.
3. I earned a couple of dollars by doing chores around the house.
4. I could never buy an airgun or a bike in this way.
5. I found a pressing need for money of my own.
6. I needed real money.

The proper sequence should be (a) 5, 3, 2, 4 (b) 2, 5, 3, 4 (c) 5, 4, 2, 3 (d) 3, 4, 2, 5

27.
1. You ask me what I intend to do after graduation.
2. My ambition is to become an engineer.

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3. I can complete this course in two years.
4. But I am not sure whether I shall get enough marks to qualify for admission to an engineering college.
5. If I don't take up engineering, I would like to do M.Sc. in Physics.
6. That would be a great relief to my parents.

The proper sequence should be (a) 2, 4, 5, 3 (b) 5, 3, 2, 4 (c) 3, 5, 4, 2 (d) 4, 2, 3, 5

28.
1. I will not be able to see you tomorrow.
2. There is only a simple laboratory test to be done.
3. Once I know what the diagnosis is, I can contact the doctor.
4. However, if you like, you can phone me.
5. We will then follow his instructions.
6. At any rate I'll see you later in the week.

The proper sequence should be (a) 5, 2, 4, 3 (b) 4, 2, 3, 5 (c) 5, 4, 2, 3 (d) 4, 3, 5, 2

29.
1. James Watt used the power of steam to drive machines.
2. With petrol engines people were able to build motor cars and aeroplanes.
3. Then, many years later, the petrol engine was invented.
4. These provided quicker means of traveling.
5. His invention was used later by other clever men to give us the railway engine.
6. The jet engine is relatively more recent.

The proper sequence should be (a) 5, 3, 2, 4 (b) 2, 3, 4, 5 (c) 2, 5, 4, 3 (d) 3, 5, 4, 2

30.
1. Bacteria in the mouth can cause bad odour and painful tooth decay.
2. Children's eating habits leave them prone to tooth decay.
3. They grow in food particles left between teeth.
4. They often eat sweets and other items between meals.
5. Therefore, regular brushing after every meal eaten at home is essential.
6. Toothpaste advertisements are truthful when they advise us to brush regularly.

The proper sequence should be (a) 2, 3, 5, 4 (b) 3, 4, 2, 5 (c) 4, 5, 2, 3 (d) 3, 2, 4, 5

31.
1. The Five-Year plans are meant for the nation's economic development.
2. What are the reasons for it?
3. One way of measuring a nation's development is by finding out how much progress there has been in the fight against poverty.
4. The reasons are many.
5. In India, every Five-Year plan ends with more people coming under the poverty line.
6. The most important is, certainly, failure on the family planning front.

The proper sequence should be (a) 4, 2, 3, 5 (b) 2, 4, 5, 3 (c) 3, 5, 2, 4 (d) 5, 3, 4, 2

32.
1. Man's growth from barbarism to civilization is supposed to be the theme of history.
2. Strong countries attack and oppress weaker ones.
3. But it is difficult to believe this ideal has been reached.
4. There is ample evidence of barbarism even today.
5. Individuals too exploit their fellows.
6. In many ways, therefore, man has not made very great progress.

The proper sequence should be (a) 3, 4, 2, 5 (b) 4, 3, 5, 2 (c) 3, 4, 5, 2 (d) 4, 2, 5, 3

33.
1. The lion used to be very widely distributed in Africa and Asia.
2. There are special forest zones set aside for wildlife in various countries.
3. Indiscriminate killing by hunters has been the cause of this drastic fall in their numbers.
4. Today they are a relatively rare species.
5. If the species survives at all, it will be only in national parks.
6. No hunting is permitted in such reserved areas.

The proper sequence should be (a) 3, 5, 2, 4 (b) 4, 5, 2, 3 (c) 5, 4, 2, 3 (d) 4, 3, 5, 2

34.
1. Jagdish was tired after the long walk through the thick jungle.
2. As night fell he came to a swampy place near a lake, where he decided to camp.
3. At last, in despair, he sprang into the branches of a nearby tree and climbed to the top.
4. But the place was so full of mosquitoes that he found it impossible to sleep.
5. He spread a blanket on the ground and stretched himself out on it.

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6. Here, to his satisfaction, he found that there were hardly any mosquitoes.

The proper sequence should be (a) 2, 5, 4, 3 (b) 2, 4, 5, 3 (c) 2, 5, 3, 4 (d) 2, 3, 4, 5

35.
1. A devastating earthquake had hit Mexico city.
2. Fifty more were later judged dangerously close to falling.
3. The quake's force was measured at 7.8 on the Richter scale.
4. In four chaotic minutes, an estimated 250 buildings collapsed in downtown Mexico city.
5. It was the world's most severe quake since the quake in Chile last March.
6. The condition of 1000 others was reported unsafe.

The proper sequence should be (a) 5, 4, 2, 3 (b) 3, 5, 4, 2 (c) 2, 3, 5, 4 (d) 4, 2, 3, 5

36.
1. When he joined the college, he was an adolescent and immature.
2. He learnt a lot from his experiences at the college.
3. He had to get suitably employed.
4. Four years of study in the college changed him completely.
5. When he left it he was ready to face the problems of life.
6. But his sagacity helped him get a good job.

The proper sequence should be (a) 2, 3, 4, 5 (b) 5, 4, 3, 2 (c) 4, 2, 5, 3 (d) 3, 5, 4, 2

37.
1. There is still another important characteristic of living things.
2. One generation is not a perfect copy of the preceding generation.
3. Plants and animals are not exactly like their parents.
4. That attribute is the capacity to evolve.
5. There is a continual realignment of inherited characteristics.
6. And abrupt changes occur too, which are called mutations.

The proper sequence should be (a) 2, 5, 3, 4 (b) 4, 3, 2, 5 (c) 3, 5, 2, 4 (d) 4, 5, 2, 3

38.
1. Your resources, like money are limited.
2. You must invest them wisely.
3. Everything cannot be directly attended to by yourself.
4. Sooner or later you; should learn to delegate your authority to others.
5. You have to depend on others.
6. For that matter the need for a leader arises only in relation to other people.

The proper sequence should be (a) 5, 4, 2, 3 (b) 3, 4, 5, 2 (c) 2, 4, 3, 5 (d) 5, 3, 4, 2

39.
1. In ancient India the city of Ujjain was quite famous.
2. Here lived at one time the poet Kalidas.
3. He was a famous learned astronomer.
4. And here also came and worked Raja Jai Singh of Jaipur.
5. It was always renowned as a seat of learning.
6. So, one can see what a great love all who care for India must feel for this ancient city.

The proper sequence should be (a) 2, 5, 4, 3 (b) 5, 2, 4, 3 (c) 3, 5, 4, 2 (d) 5, 4, 2, 3

40.
1. One of the odd-looking birds of the ocean is the penguin.
2. Penguins cannot fly.
3. It is found in the cold regions of the Antarctic circle.
4. Their wings have been changed into swimming flippers.
5. They use them like oars.
6. With the aid of flippers they can dive into the water.

The proper sequence should be (a) 2, 3, 4, 5 (b) 3, 2, 4, 5 (c) 4, 5, 2, 3 (d) 3, 4, 5, 2

41.
1. Clothes should fit well.
2. Clothing that is too slack chafes the skin and is uncomfortable.
3. Tight garments can constrict the organs of the body, especially those of the abdomen.
4. Clothes should be kept clean.
5. If they are too tight they can constrict the blood vessels in the skin.
6. They absorb sweat from the body and pick up dust from the surroundings.

The proper sequence should be (a) 2, 3, 5, 4 (b) 3, 4, 2, 5 (c) 5, 4, 3, 2 (d) 5, 3, 2, 4

42.
1. Get hold of the catalogues of the colleges in the United States.
2. I think there is a common feature and that every course given has a similar aim.
3. Is there any common feature in these courses?

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4. You will find courses in innumerable subjects.
5. Is there any aim which all of them have?
6. They all aim at the first rate.

The proper sequence should be (a) 4, 3, 5, 2 (b) 2, 3, 4, 5 (c) 4, 3, 2, 5 (d) 2, 4, 5, 3

43.
1. We were so evenly matched that for a time the end was difficult to tell.
2. Already I was counting him a dead man and myself victorious.
3. I had only to wear him out to have him at my mercy.
4. Presently, however, there came a change.
5. My opponent's wild living made him incapable of coping with prolonged bout and his strength seemed to start ebbing away.
6. Then his comrade's knife, thrown at me, struck him on the back and, piercing it, quite finished him.

The proper sequence should be (a) 2, 3, 4, 5 (b) 3, 4, 5, 2 (c) 4, 3, 5, 2 (d) 4, 5, 3, 2

44.
1. John Young, the astronaut, piloted the 75-ton space-shuttle, Columbia.
2. The Columbia, however, landed safely at the Edwards Air Force base in the Mojave desert.
3. The space-shuttle circled the Earth 36 times.
4. It was dangerous because a re-usable craft was being used now.
5. This flight was fraught with dangers.
6. And it moved smoothly to a stop as the crew rushed to greet it.

The proper sequence should be (a) 2, 3, 5, 4 (b) 5, 3, 4, 2 (c) 2, 4, 5, 3 (d) 3, 5, 4, 2

45.
1. Rutherford was the son of a Scot's emigrant to New Zealand.
2. They had 12 children, of whom Rutherford was the fourth.
3. His father established the first flax mill in South Island.
4. He was brought up in a real frontier atmosphere and it entered into the nature of the man.
5. His mother was the first woman school teacher in New Zealand.
6. Life was hard, but it was adventurous.

The proper sequence should be (a) 2, 4, 3, 5 (b) 3, 5, 4, 2 (c) 3, 4, 5, 2 (d) 3, 5, 2, 4

46.
1. Life is a gift of God to man.
2. What an invaluable gift!
3. Every morning he fills 24 hours in wallets of each of us and never asks questions.
4. The other is time.
5. Irrespective of these gifts, we grumble.
6. Oh Lord! What fools we mortals are?

The proper sequence should be (a) 2, 3, 4, 5 (b) 2, 4, 3, 5 (c) 3, 4, 2, 5 (d) 4, 5, 2, 3

47.
1. There was a legend among our people that the island had once been covered with tall trees.
2. This was a long time ago, at the beginning of the world when Tumai and Mukat ruled.
3. Tumai wished people to die.
4. The two gods quarrelled about many things.
5. Mukat did not.
6. Tumai angrily went down, down to another world; so people die today because he did.

The proper sequence should be (a) 2, 4, 3, 5 (b) 2, 5, 4, 3 (c) 5, 2, 4, 3 (d) 5, 3, 2, 4

48.
1. Arun suddenly found himself in the streets.
2. There was a little money in the bank and he had some stock on hand.
3. The prices were going down, and he could hardly realize a few hundred rupees.
4. At first he could hardly understand the full significance of this collapse.
5. But the stock moved out slowly.
6. When he applied for the refund of his security, there was hardly anyone at the other end to receive his application.

The proper sequence should be (a) 2, 5, 3, 4 (b) 5, 3, 4, 2 (c) 4, 2, 5, 3 (d) 2, 3, 5, 4

49.
1. Science has given us powers tit for the gods.
2. For example, we do not know how to manage our machines.
3. Yet we use them like small children.
4. But in practice, they have become man's masters.
5. Machines were made to be man's servants.

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6. And we should remember that they are very stern masters.

The proper sequence should be (a) 4, 3, 2, 5 (b) 2, 3, 4, 5 (c) 3, 2, 5, 4 (d) 3, 2, 4, 5

50.
1. I am the manager of a travel agency in the city.
2. I usually catch the 8 O'clock train for my journey to the office.
3. I live fifteen kilometres out of the city where I have a small room.
4. I go to work on the electric train every day.
5. The train takes about twenty five minutes to get to the city.
6. I spend those twenty five minutes doing crosswords.

The proper sequence should be (a) 2, 4, 5, 3 (b) 4, 3, 2, 5 (c) 3, 5, 2, 4 (d) 5, 2, 4, 3

51.
1. The oil found in natural state is called crude oil.
2. It is used as a fuel in heaters and lamps.
3. It is treated in refineries; the most common form of treatment is heating.
4. Gas that comes off the oil later is condensed into paraffin.
5. When crude oil is heated, the first vapours to rise are cooled and become the finest petrol.
6. Last of all, the lubricating oils of various grades are produced.

The proper sequence should be (a) 3, 5, 2, 4 (b) 5, 2, 3, 4 (c) 5, 3, 4, 2 (d) 3, 5, 4, 2

52.
1. It is very warm and sticky today.
2. That is a good idea.
3. I wonder what the weather is going to be like tomorrow.
4. Let's listen to the weather report for tomorrow on the radio.
5. The paper here says its going to be fair and sunny.
6. A good rain would cool things off a little.

The proper sequence should be (a) 3, 5, 4, 2 (b) 4, 3, 5, 2 (c) 3, 4, 2, 5 (d) 4, 5, 2, 3

53.
1. He went to his friends, but none of them was ready to help him now.
2. He had to look after the farmer's pigs.
3. And when he was hungry he ate the food which was given to the pigs.
4. He went away from the city and wandered round the countryside looking for food to eat.
5. In the end he went to the house of a farmer and became his servant.
6. Now the Youngman understood that he had made a mistake.

The proper sequence should be (a) 2, 5, 4, 3 (b) 4, 5, 2, 3 (c) 5, 3, 2, 4 (d) 3, 2, 5, 4

54.
1. Convention has a necessary part to play in the life of everyone.
2. It is necessary and useful for this reason.
3. Of course, there is nothing absolute about conventions.
4. They vary from country to country, from age to age.
5. In all social affairs it prescribes more or less generally accepted rules of behaviour.
6. Their purpose, however, is always the same.

The proper sequence should be (a) 5, 3, 4, 2 (b) 2, 3, 5, 4 (c) 4, 2, 5, 3 (d) 5, 2, 3, 4

55.
1. A great part of Arabia is desert.
2. The sand is so hot that you cannot walk over it with your bare feet in the day time.
3. These springs are few and far apart, but wherever there is one, green grass very soon covers the ground all around it.
4. Here there is nothing but sand and rock.
5. Here and there in the desert are springs of water that come from deep down under the ground.
6. Such place is called an oasis.

The proper sequence should be (a) 2, 5, 4, 3 (b) 4, 5, 3, 2 (c) 4, 2, 5, 3 (d) 2, 3, 5, 4

56.
1. Most of you probably did not see Gandhiji at close quarters.
2. One of these qualities was that he managed to draw out the good in another person.
3. But he somehow spotted the good and laid emphasis on that good.
4. He had amazing qualities.
5. The other person may have had plenty of evil in him.
6. The result was that that poor man had to try to be good.

The proper sequence should be (a) 3, 2, 5, 4 (b) 4, 2, 5, 3 (c) 2, 4, 3, 5 (d) 3, 5, 2, 4

57.
1. Everybody thinks that this is the Age of Reason.

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2. Reason takes a backseat at such times.
3. The ordinary events of life seem to support this view.
4. We must therefore avoid the development of such situations.
5. But the behaviour of people in crises makes us doubt this.
6. Obviously we must re-examine the view that this is the age of Reason.

The proper sequence should be (a) 4, 3, 2, 5 (b) 5, 4, 3, 2 (c) 2, 5, 4, 3 (d) 3,5, 4, 2

58.
1. Imitation is not civilization.
2. As ass in a lion's skin never makes a lion.
3. It is verily the sign of awful degradation in a man.
4. Cowardly imitation never makes for progress.
5. When a man has begun to hate himself, then the last blow has come.
6. When a man has begun to be ashamed of his ancestors, the end has come.

The proper sequence should be (a) 2, 3, 4, 5 (b) 5, 2, 4, 3 (c) 2, 4, 3, 5 (d) 3, 5, 2, 4

59.
1. There is no sound more familiar in Calcutta than the clanking of its tramcars.
2. For a growing body of opinion in the city, trams are a symbol of urban blight.
3. It is also an irritant.
4. All day and late into the night the trundling roll of a tram has become a symbol, a portent.
5. Slow, overcrowded and unwieldy, they are thought of as obstructionist and outmoded.
6. Their progress is regarded with the mixture of dread and embarrassment reserved for the approach of a cantankerous old aunt.

The proper sequence should be (a) 4, 3, 2, 5 (b) 4, 3, 5, 2 (c) 3, 5, 2, 4 (d) 2, 5, 4, 3

60.
1. Having visited the Taj Mahal many tourists think that Agra has little else to offer.
2. One of these is surely the tomb of Itimad-ud-daulah.
3. The design of the whole tomb was given by his daughter Nur Jahan.
4. After seeing the Taj one could profitably visit half a dozen other Mughal buildings.
5. This tomb has the delicacy of a baroque jewel case.
6. There are few other buildings to match the delicacy of this tomb.

The proper sequence should be (a) 4, 5, 3, 2 (b) 3, 5, 4, 2 (c) 5, 2, 4, 3 (d) 4, 2, 5, 3

61.
1. For years the old chair stood in one of the empty antics.
2. So when I saw it for the last time, it stood there.
3. When my mother died, I wanted to sell it but could not.
4. It was there for many years after my father died.
5. I peeped in the past.
6. I saw my parents madly in love again.

The proper sequence should be (a) 2, 3, 4, 5 (b) 5, 4, 3, 2 (c) 4, 2, 3, 5 (d) 4, 3, 2, 5

62.
1. Newton was perhaps the greatest scientist that ever lived.
2. But when he was only 22, a terrible plague epidemic swept over England.
3. He was the son of a Lincolnshire farmer, and was born in 1642.
4. Therefore the universities were closed.
5. He went to Cambridge to study mathematics when he was 19.
6. Newton went home and worked quietly by himself for about 18 months.

The proper sequence should be (a) 5, 2, 4, 3 (b) 3, 2, 5, 4 (c) 5, 3, 2, 4 (d) 3, 5, 2, 4

63.
1. Unlike many modern thinkers, Tagore had no blueprint for the world's salvation.
2. His thought will therefore never be out of date.
3. He merely emphasised certain basic truths which men may ignore only at their peril.
4. He believed in no particular 'ism'.
5. He was what Gandhiji rightly termed the Great Sentinel.
6. As a poet he will always delight, as a singer he will always enchant, as a teacher he will always enlighten.

The proper sequence should be (a) 5, 4, 2, 3 (b) 2, 4, 3, 5 (c) 4, 5, 2, 3 (d) 4, 3, 2, 5

64.
1. Tom Walker and his wife were always at loggerheads.
2. She never tired of reproaching him on this score.
3. Tom was incurably lazy and talkative
4. One day Mrs. Walker caught a deadly cold, and shortly afterwards, died.

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	5. This was a constant source of irritation to his wife. 6. Tom silently thanked God for this relief. The proper sequence should be (a) 2, 4, 3, 5 (b) 3, 5, 2, 4 (c) 5, 3, 4, 2 (d) 2, 5, 3, 4
65.	1. I sat at the table and ate. 2. My breathing became suddenly difficult. 3. I concentrated on my food and I was convinced I had to eat. 4. I stopped, however, any exhibition of the extraordinary. 5. But lungs have temperament. 6. I was just the normal Ramaswamy, husband of Madeleine. The proper sequence should be (a) 2, 4, 5, 3 (b) 3, 5, 2, 4 (c) 3, 5, 4, 2 (d) 5, 2, 4, 3
66.	1. The 'touch-me-not' plant folds up its leaves when touched. 2. How is the plant able to do this? 3. At the lower end of each leaf is a tiny swelling, called the pulvinus. 4. The pulvinus act as the 'brain' or control centre of the leaf. 5. It is only in recent years that a possible answer has been found. 6. The folding up of the leaves is controlled by the pulvinus. The proper sequence should be (a) 4, 5, 3, 2 (b) 2, 3, 5, 4 (c) 4, 3, 5, 2 (d) 2, 5, 3, 4

Answer Keys

Answer Keys: Exercise: 3.1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	a	d	d	c	c	d	b	d	c	d	a	a	b	d	c	d	d	b	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
b	a	a	c	a	c	d	b	b	d	a	c	d	c	d	b	b	c	a	a
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	b	c	b	c	b	c	d	d	c	c	c	d	c	c	a	c	b	a	d
61	**62**	**63**	**64**	**65**															
c	d	d	a	b															

Answer Keys: Exercise: 3.2

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	c	b	b	b	b	b	c	a	d	a	c	c	b	a	c	a	d	c	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
b	b	a	d	a	a	a	b	a	d	c	a	d	a	b	c	b	c	b	b
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	a	d	d	d	b	a	c	c	b	d	a	b	d	c	b	d	c	b	d
61	**62**	**63**	**64**	**65**	**66**														
d	d	a	b	d	b														

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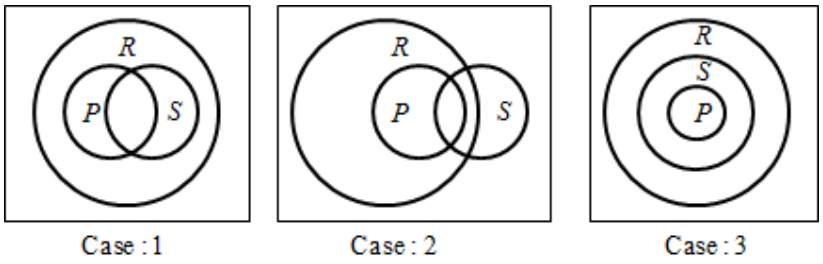
Chapter 4 : Reasoning

4.1 Syllogism

A syllogism is a logical argument where a quantified statement of a specific form (the conclusion) is inferred from two other quantified statements (the premises). The quantified statements are all of the form "Some/all A are B," or "Some/all A are not B," and each syllogism combines three predicates or properties. Notice that "All A are not B" can be expressed equivalently in natural language as "No A are B," and "Some A are not B" as "Not all A are B." We can see these quantified statements as describing relations between predicates, which is well-suited to describing hierarchies of properties. A syllogism is called valid if the conclusion follows logically from the premises, whatever we take the real predicates and objects to be: if the premises are true, the conclusion must be true. The syllogism is invalid otherwise. The problem of syllogism can be solved by using a little intelligence and common sense but we need to have a definite and well defined method to tackle the problem. The best method to solve the syllogism question is using the Venn-diagram. Let us consider some examples:

Example [GA-2013 (2 marks)]: *All professors are researchers. Some scientists are professors*
Which of the given conclusions is logically valid and is inferred from the above arguments:
(a) All scientists are researchers
(b) All professors are scientists
(c) Some researchers are scientists
(d) No conclusion follows

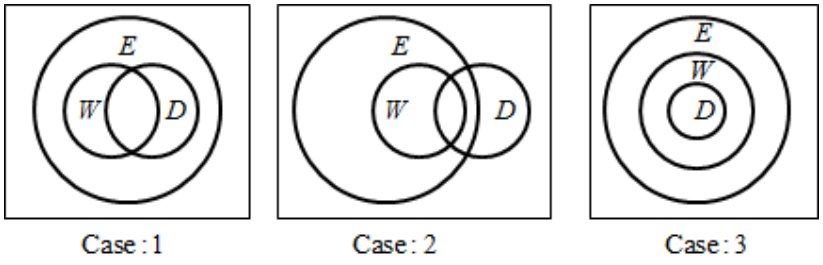
Solution (c): Let R, P, S be Researchers, Professors and Scientists. Based on the given data, we have three cases of Venn diagram, as shown in figure. Option (a) is not correct because of case 2; option (b) is not correct because of case 1 and 2. Option (c) is satisfied by all the cases, as from case 1 and case 2 we have 'some researchers are scientist'; and from case 3 we have 'all scientist are researchers' so taking intersection of the results we have 'some researchers are scientist'. Thus option (c) is correct.



Case : 1 Case : 2 Case : 3

Example [GA-2014 (1 mark)]: *All women are entrepreneurs. Some women are doctors.*
Which of the following conclusions can be logically inferred from the above statements?
(a) All women are doctors
(b) All doctors are entrepreneurs
(c) All entrepreneurs are women
(d) Some entrepreneurs are doctors

Solution (d): Let E, W, D be Entrepreneurs, Women and Doctors. Based on the given data, we have three cases of Venn diagram, as shown in the figure. Option (a) is not correct because of case 1,2 and 3; option (b) is not correct because of case 2; option (c) is not correct because of case 1, 2, and 3; option (d) is satisfied by all the cases, and thus option (d) is correct.



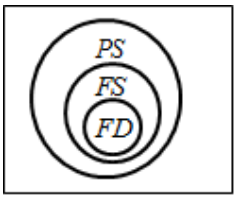
Case : 1 Case : 2 Case : 3

Example [GA-2015 (2 marks)]: Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.
Statements:
I. All film stars are playback singers.
Conclusions:
I. All film directors are playback singers.

II. All film directors are film stars.
(a) Only conclusion I follows
(c) Neither conclusion I nor II follows

II. Some film stars are film directors.
(b) Only conclusion II follows
(d) Both conclusions I and II follow

Solution (d): Let FD, FS, PS be film stars, film directors and playback singers. Based on the given data, we have Venn diagram shown in figure. We can judge from the figure that both the conclusions are following the given statements; and thus option (d) is correct.

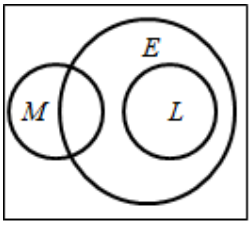


Example [GA-2015 (2 marks)]: Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

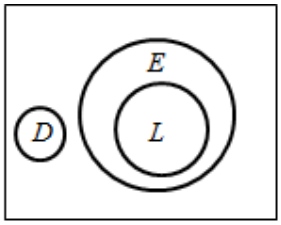
Statements:
I. No manager is a leader.
II. All leaders are executives.
(a) Only conclusion I follows
(c) Neither conclusion I nor II follows

Conclusions:
I. No manager is an executive.
II. No executive is a manager.
(b) Only conclusion II follows
(d) Both conclusions I and II follows

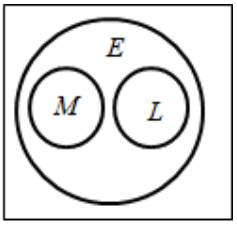
Solution (c): Let M, L, E be manager, leader and executive. Based on the given data, we have three cases of Venn diagram, which are shown in figure. Conclusions I does not follow because of case 1 and 3; conclusion II does not follow because of case 1 and case 3. Thus option (c) is correct.



Case : 1



Case : 2



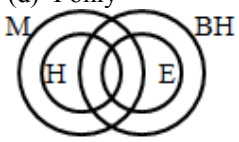
Case : 3

Example [GA-2016 (2 marks)]: Fact 1: **Humans are mammals.** Fact 2: **Some humans are engineers.** Fact 3: **Engineers build houses.** If the above statements are facts, which of the following can be logically inferred?

I. All mammals build houses
II. Engineers are mammals
III. Some humans are not engineers

(a) II only (b) III only (c) I, II and III (d) I only

Solution (b): The following Venn diagram is drawn based on the given facts, where, M: Mammals; H: Humans; E: Engineers; BH: Build Houses Hence from the diagram, we conclude that statements I and II are not correct; on the other hand statement III is correct. So option (b) is correct.



Exercise 4.1

For question 1 to 10: choose the correct conclusion which can be logically inferred from the given statements. For questions 11 to 35: choose the correct option based on the given statements followed by their conclusions.

1.	**Statements: I. All metals are bars**	**II. Some cylinders are metals**
	(a) Some bars are cylinders	(b) Some cylinders are bars
	(c) All metals are cylinders	(d) No conclusion follows
2.	**Statements: I. All woods are chairs**	**II. No tables are chairs**
	(a) All chairs are tables	(b) All tables are chairs
	(c) Some tables are chairs	(d) No conclusion follows
3.	**Statements: I. No pen is pencil**	**II. All pencils are scales**
	(a) No pens are scales	(b) No scales are pens
	(c) Some scales are pens	(d) Some scales are not pens

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4.	**Statements: I. All mangoes are chairs**	**II. Some chairs are tables**
	(a) All mangoes are tables	(b) Some tables are mangoes
	(c) No mango is a table	(d) No conclusion follows
5.	**Statements: I. Some boys are students**	**II. All students are teenagers**
	(a) All teenagers are students	(b) Some boys are teenagers
	(c) All boys are teenagers	(d) No conclusion follows
6.	**Statements: I. All Lotus are flowers**	**II. No Lily is a Lotus**
	(a) No Lily is flowers	(b) Some Lilies are flowers
	(c) Some flowers are Lotus	(d) No conclusion follows
7.	**Statements: I. All gardens are schools**	**II. All schools are colleges**
	(a) All colleges are gardens	(b) Some gardens are not colleges
	(c) Some colleges are gardens	(d) Some gardens are colleges
8.	**Statements: I. Some cups are spoons**	**II. Some spoons are saucers**
	(a) All cups are saucers	(b) Some saucers are cups
	(c) Some cups are saucers	(d) No conclusion follows
9.	**Statements: I. No flower is mango**	**II. No mango is cherry**
	(a) No flower is cherry	(b) Some cherries are mango
	(c) Some flowers are cherries	(d) No conclusion follows
10.	**Statements: I. Some pubs are cows**	**II. No kitten are pubs**
	(a) No pubs are kitten	(b) Some cows are kitten
	(c) Some kitten are cows	(d) No conclusion follows
11.	**Statements: I. Some spoons are glasses**	**II. Some fruits are spoons**
	Conclusions: I. Some glasses are fruits	**II. All fruits are spoons**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(b) Neither conclusion I nor II follow
12.	**Statements: I. All jungles are lions**	**II. Some lions are horses**
	Conclusions: I. Some lions are jungles	**II. All horses are jungles**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
13.	**Statements: I. All birds are tall**	**II. Some tall are peacock**
	Conclusions: I. Some birds are peacock	**II. Some peacock are tall**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
14.	**Statements: I. Some scooters are cars**	**II. All cars are trains**
	Conclusions: I. Some scooters are trains	**II. No car is a scooter**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
15.	**Statements: I. All animals are dogs**	**II. All dogs are cats**
	Conclusions: I. All animals are cats	**II. All cats are animals**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
16.	**Statements: I. All gold is divine**	**II. All houses are divine**
	Conclusions: I. All gold is house	**II. All houses are gold**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
17.	**Statements: I. All huts are hotels**	**II. All hotels are temples**
	Conclusions: I. Some temples are huts	**II. Some temples are hotels**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
18.	**Statements: I. All pencils are dusters**	**II. All chairs are dusters**
	Conclusions: I. Some pencils are chairs	**II. Some dusters are pencils**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
19.	**Statements: I. All roses are flowers**	**II. All flowers are plants**

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	Conclusions: I. All roses are plants	**II. All plants are roses**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
20.	**Statements: I. All bullets are rifles**	**II. Some rifles are swords**
	Conclusions: I. Some bullets are rifles	**II. All swords are bullets**
	(a) Only conclusion I follow	(b) Only conclusion II follow
	(c) Both conclusion I and II follow	(d) Neither conclusion I nor II follow
21.	**Statements: I. All roads are poles**	**II. No pole is a hotel**
	Conclusions: I. Some roads are hotels	**II. Some hotels are poles**
	(a) Only conclusion I follows	(b) Only conclusion II follows
	(c) Either conclusion I or II follows	(d) Neither conclusion I nor II follows
22.	**Statements: I. No glass is tube light**	**II. All glasses are bulb**
	Conclusions: I. No tube light is bulb	**II. No bulb is tube light**
	(a) Only conclusion I follows	(b) Only conclusion II follows
	(c) Either conclusion I or II follows	(d) Neither conclusion I nor II follows
23.	**Statements: I. Some books are pens**	**II. No pen is pencil**
	Conclusions: I. Some books are pencils	**II. No book is pencil**
	(a) Only conclusion I follows	(b) Only conclusion II follows
	(c) Either conclusion I or II follows	(d) Neither conclusion I nor II follows
24.	**Statements: I. Some copies are pens**	**II. No pen is red**
	Conclusions: I. Some copies are red	**II. Some pens are copies**
	(a) Only conclusion I follows	(b) Only conclusion II follows
	(c) Either conclusion I or II follows	(d) Neither conclusion I nor II follows
25.	**Statements: I. Some Men are Indian**	**II. No Indian is African**
	Conclusions: I. Some Men are African	**II. Some Men are not African**
	(a) Only conclusion I follows	(b) Only conclusion II follows
	(c) Either conclusion I or II follows	(d) Neither conclusion I nor II follows
26.	**Statements: I. Some doors are fans**	**II. All fans are bulbs**
	Conclusions: I. All bulbs are fans	**II. All doors are bulbs**
	III. Some doors are bulbs	**IV. Some fans are doors**
	(a) Only conclusion I and II follows	(b) None of the conclusions follow
	(c) All conclusions follow	(d) Only conclusion III and IV follows
27.	**Statements: I. Some nuts are bottles**	**II. No bottle is sky**
	Conclusions: I. No bottle is nut	**II. No nut is bottle**
	III. Some bottles are skies	**IV. Some nuts are skies**
	(a) Either conclusion III or IV follows	(b) Either conclusion II or III follows
	(c) Either conclusion II or IV follows	(d) None of the conclusion follows
28.	**Statements: I. No bull is cow**	**II. All cows are insects**
	Conclusions: I. Some insects are bulls	**II. All insects are bulls**
	III. Some insects are cows	**IV. Some insects are not cows**
	(a) Either conclusion III or IV follows	(b) Only conclusions I, II and III follows
	(c) Only conclusions II, III and IV follows	(d) Only conclusions I and II follows
29.	**Statements: I. Some bullets are cars**	**II. Some cars are trucks**
	Conclusions: I. Some bullets are trucks	**II. No bullet is truck**
	III. All trucks are cars	**IV. All cars are bullets**
	(a) Either conclusion I or II follows	(b) Either conclusion II or IV follows
	(c) Only Conclusion III follows	(d) Conclusions I and II follows
30.	**Statements: I. All cats are rats**	**II. Some rats are mats**
	Conclusions: I. Some mats are rats	**II. Some rats are cats**
	III. Some cats are mats	**IV. Some mats are not rats**
	(a) Either conclusion I or III follows	(b) Either conclusion II or IV follows
	(c) Only conclusion I and II follows	(d) None of the conclusions follows
31.	**Statements: I. Some eagles are bats**	**II. No bat is white**
	Conclusions: I. Some eagles are white	**II. Some bats are white**

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	III. Some eagles are not white		**IV. Some bats are eagles**
	(a) Only conclusion III follows	(b) Only conclusion IV follows	
	(c) Either conclusion I or III and IV follows	(d) Either conclusion III or IV follows	
32.	**Statements: I. All points are lines**		**II. Some lines are circle**
	Conclusions: I. Some circles are points		**II. Some lines are points**
	III. No circle is a point		**IV. All circles are lines**
	(a) Either conclusion I or II follows	(b) Only conclusion IV follows	
	(c) Only conclusion I follows	(d) Either conclusion I or III and II follows	
33.	**Statements: I. Some woods are cables**		**II. All cables are wires**
	Conclusions: I. All wires are cables		**II. All woods are cables**
	III. Some woods are not cables		**IV. All wires are woods**
	(a) Only conclusions I and II follows	(b) Only conclusions III and IV follows	
	(c) Only conclusion IV follows	(d) None of the conclusion follows	
34.	**Statements: I. All lemons are bananas**		**II. All bananas are oranges**
	Conclusions: I. Some oranges are bananas		**II. All bananas are lemons**
	III. Some lemons are not oranges		**IV. Some oranges are lemons**
	(a) All conclusions follows	(b) Only conclusions I and IV follows	
	(c) Only conclusions I and III follows	(d) Only conclusion I follows	
35.	**Statements: I. All buses are roads**		**II. All roads are rivers**
	Conclusions: I. All buses are rivers		**II. Some roads are buses**
	III. Some rivers are roads		**IV. Some rivers are buses**
	(a) None of the conclusions follow	(b) Only conclusion I and II follows	
	(c) Only conclusions II, III and IV follows	(d) All conclusions follows	

4.2 Blood Relation

Important Relations

- Your mother's or father's son is your brother
- Your mother's or father's daughter is your sister
- Your mother's brother is your maternal uncle
- Your father's brother is your Paternal uncle
- Your mother's or father's sister is your aunt
- Your mother's or father's father is your grand father
- Your mother's or father's mother is your grand mother
- Your son's wife is your daughter in law
- Your daughter's husband is your son in law
- Your husband's or wife's father is your father in law
- Your husband's or wife's mother is your mother in law
- Your husband's or wife's brother is your brother in law
- Your husband's or wife's sister is your sister in law
- Your sister's husband is your brother in law
- Your brother's or sister's son is your nephew
- Your brother's or sister's daughter is your niece

Types of problems

- **Single person blood relations:** These are relations between two people only.
- **Mixed blood relations:** In this, mutual blood relations depending on more than two persons mentioned. These type of problems can be solved with the help of diagrams.
- **Coded blood relations:** In this type, relationships represented by codes. We have to analyse the required relation based on the given code.

Example: Pointing to a photograph, Vipul said, 'She is the daughter of my grandfather's only son.' How is Vipul related to the girl in the photograph?

(a) Father (b) Cousin (c) Brother (d) Uncle

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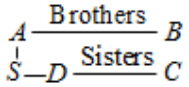
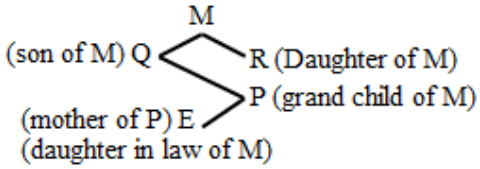
Solution (c): My grandfather's only son is my father. So the girl is the daughter of Vipul's father, i.e. Vipul is the girl's brother.

Example: A & B are brothers and C and D are sisters. A's son is D's brother. How is B related to C?
(a) Father (b) Cousin (c) Brother (d) Uncle
Solution (d): Let S be the son of A. If A's son S is D's brother then D is a daughter of A; C is a daughter of A and thus C's father's brother is her uncle.



Example: If P + Q means P is husband of Q, P/Q means P is the sister of Q, P*Q means P is the son of Q. How is D related to A in D*B + C/A?
(a) Nephew (b) Cousin (c) Niece (d) Sister
Solution (a): C/A: C is sister of A; B + C/A: B is brother in law of A (sister's husband); D*B + C/A: D is nephew of A (sister's husband's son means sister's son i.e., nephew).

Example [GA-2016 (1 mark)]: M has a son **Q** and a daughter **R**. He has no other children. **E** is the mother of **P** and daughter-in-law of **M**. How is **P** related to **M**? **[AR, CY, EC, IN, MA, PE – 2016 (1 marks)]**
(a) **P** is the son-in-law of **M**. (b) **P** is the grandchild of **M**.
(c) **P** is the daughter-in law of **M**. (d) **P** is the grandfather of **M**.
Solution (b): From the following tree-diagram, we can say that Q and E are married, and P is the child of Q and E. So P is the grand child of M as Q is the son of M.
So option (b) is correct.



Exercise: 4.2
Choose the correct option for the question asked in the following problems

1. Pointing to a Ramesh, a Radha said, "His mother is the only daughter of my mother". How is the Radha related to Ramesh?
   (a) Mother (b) Grandmother (c) Sister (d) Daughter
2. Pointing towards a woman, Rakesh said "I am the only son of his father's one of the sons". How woman is related to Rakesh?
   (a) Nephew (b) Uncle (c) Either father or uncle (d) Father
3. Pointing to a man, Deepak said, "His only brother is the father of my daughter's father". How is the man related to Deepak?
   (a) Father (b) Grandfather (c) Uncle (d) Brother-in-law
4. If Rupali says, "Neelam's father Raj is the only son of my father-in-law, Mahesh"; then how Rekha, who is sister of Neelam, is related to Mahesh?
   (a) Daughter (b) Wife (c) Daughter-in-law (d) None of these
5. Pointing towards a person in a photograph, Amit said, "She is the only daughter of the mother of my brother's sister". How is the person in photograph related to Amit?
   (a) Daughter (b) Sister (c) Wife (d) Cousin
6. If A is B's brother, B is C's sister and C is D's father. How D is related to A?
   (a) Brother (b) Sister (c) Nephew (d) Cannot be determined
7. Vaishali's mother is the daughter of Vivek's sister. How is Vivek's mother related to Vaishali's mother?
   (a) Mother (b) Daughter (c) Sister (d) Grandmother
8. Vivek is the son of Ashok. Neha is the daughter of Sagar. Soniya is the mother of Neha. Sohan is the brother of Neha. How is Sohan related to Soniya?
   (a) Brother (b) Father (c) Son (d) Cannot be determined
9. Sohan is the son of Suresh. Sneha is the daughter of Vivek. Smriti is the mother of Sneha. Sagar is the brother of Sneha. How is Sagar related to Smriti?

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(a) Brother (b) Father (c) Son (d) Cannot be determined

10. If K is the mother of M, who is the wife of O; N is the brother of K and L is the husband of K. How is L related to O?
(a) Father (b) Mother-in-law (c) Brother-in-law (d) Father-in-law

11. Pointing to Amit, Radha said, "His father is the only son of my grandfather". How is Radha related to Amit?
(a) Brother (b) Sister (c) Mother (d) Daughter

12. Rupa said to Meena, "You are the daughter-in-law of the grandmother of my father's only son." How is Rupa related to Meena?
(a) Aunt (b) Sister (c) Mother (d) Cannot be determined

13. Pointing to a photograph, Sujeet said, "I have no brother or sister but that man's father is my father's son". Whose photograph was it?
(a) His son's (b) His father's (c) His nephew's (d) Cannot be determined

14. Sujeet said to Monika, "Your only brother's son is my wife's brother". How is Monika related to the Sujeet's wife?
(a) Mother in law (b) Aunt (c) Sister (d) Mother

15. Pointing to a photograph Simran says, "This man's son's sister is my mother-in-law." How is the woman's husband related to the man in the photograph?
(a) Son-in-law (b) Brother (c) Nephew (d) Grandson

16. A man goes to the house of Monica who is the neighbour of Vijay who has a daughter Neelam. Neelam studies in First year. Ashwini is the father of Vikas and is married to Mona whose sister is Vijay. What is the relation of Vijay and Vikas?
(a) Cousin (b) Grandson (c) Nephew (d) Niece

17. Shilpa introduces a man as the son of the brother of her mother. How is the man related Shilpa?
(a) Uncle (b) Cousin (c) Son (d) None of these

18. Pointing to Vijay, Rekha said, "He is the son of my father's only son." How is Vijay's mother related to Rekha?
(a) Sister-in-law (b) Mother (c) Daughter (d) None of these

19. Introducing Ajay, Vijay said, "He is the only son of my father's only son. How is Vijay related to Ajay?
(a) Father (b) Uncle (c) Cousin (d) Cannot be determined

20. Sunil ' and 'Mona' are married couple. 'Akash' and 'Vinod are brothers. 'Akash' is the brother of 'Sunil'. How is 'Vinod' related to 'Mona'?
(a) Brother (b) Brothr-in-law (c) Cousin (d) Cannot be determined

21. R's father is G's son. H is the paternal uncle of R and M is brother of G's. How is M related to H?
(a) Nephew (b) Brother (c) Paternal uncle (d) Cannot be determined

22. A and B are sisters. P is the son of Q and B is the mother of Q. If C is the son of A, then how C is related to Q?
(a) Grand-daughter (b) Cousin (c) Grand-mother (d) None of these

23. B is the father of C but C is not his son. Q is the daughter of C. A is the spouse of B. P is the brother of C. R is the son of P. S is the spouse of P. T is the father of S. How Q is related to B?
(a) Mother (b) Father (c) Grand-son Grand-daughter

24. S and L are two sons of M. Q is the mother of P who is the only sister of L. G is the wife of R who is the son of K. M is the brother of G. How R is related to M?
(a) Brother (b) Aunt (c) Brother-in-law (d) Daughter

25. A's father B is D's paternal uncle and E's husband C is A's paternal uncle. How is E related to D?
(a) Cousin (b) Mother (c) Sister (d) Aunt

26. Komal is mother-in-law of Sita who is sister-in-law of Vivek. Susheel is father of Ashok, the only brother of Vivek. How is Komal related to Ashok?
(a) Mother (b) Wife (c) Aunt (d) None of these

27. A is the son of X. B is the X's sister. B has a son Y and a daughter C. Z is the maternal uncle of Y. How A is related to Y?
(a) Nephew (b) Brother (c) Cousin-brother (d) None of these

28. Y, the son of X was married to Z, whose sister A was married to B, the brother of Y. How A is related to X?

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(a) Daughter-in-law (b) Mother-in-law (c) Sister-in-law (d) None of these

29. In a joint family, there are father, mother, 2 married daughters and one unmarried son. Both daughters have 2 sons each. How many male members are there in the family?
(a) 7 (b) 8 (c) 9 (d) 10

30. There are six persons A, B, C, D, E and F. C is the sister of F and both are children of A. B is the brother of E's husband. D is the father of A and grandfather of F. There are two fathers, one mother and three brothers in the family. How many male members are there?
(a) 2 (b) 3 (c) 4 (d) Cannot be determined

31. All the six members of a family A, B, C, X, Y and Z are traveling together. B is the son of C but C is not the mother of B, A and C are a married couple. X is the daughter of A. Y is brother of C. Z is the brother of B. How many children does A have?
(a) 1 (b) 2 (c) 3 (d) 4

32. A, B, C, D, E, F, and G are seven members of a family. They belong to three generations. There are two married couples belonging to two different generations. C is son of F and is married to G. D is granddaughter of B. E's father is grandfather of A. B's husband is father-in -law of G. F has only one son. How many female members are there among them?
(a) 2 (b) 3 (c) 4 (d) None of these

33. A party consists of grandmother, father, mother, three sons and their wives and three daughters to each of the sons. How many females are there is all?
(a) 12 (b) 14 (c) 16 (d) 10

34. '$A-B$' means 'A is the mother of B'; '$A\times B$' means A is the father of B' and '$A+B$' means 'A is the daughter of B'. Now if $P-Q\times R+S$ then which of the following is not true?
(a) *S* is mother of *R* **(b) *P* is grandmother of *R***
(c) *S* is daughter of *P* **(d) *Q* is husband of *S***

35. If $P+Q$ means P is brother of Q; $P\div Q$ means P is mother of Q. Then $A+C\div B$ indicates?
(a) ***A*** is the nephew of ***B*** (b) ***A*** is the uncle of ***B***
(c) ***A*** is the brother of ***B*** (d) ***A*** is the father of ***B***

4.3 Logical Sequence of Words

In this type of question, a group of words is given and are required to arrange these words in a meaningful order, such as the sequence of occurrence of events, increasing or decreasing size or value, etc. For example, if we have given the words like 'Birth, Funeral, Death, Education, Marriage' and we have to arrange the given words in logical sequence. We know that a person first born then pursue education, after then he or she is getting married, and after death comes then finally his or her funeral happens. So logical sequence of given words is 'Birth, Education, Marriage, Death, Funeral'.

Exercise: 4.3

In each of the following questions, arrange the given words in a meaningful sequence, and then choose the most appropriate sequence among the options provided below each questions.

1.	1. Exhaust	2. Night	3. Day	4. Sleep	5. Work
	(a) 3, 5, 1, 2, 4	(b) 3, 5, 1, 4, 2	(c) 3, 5, 2, 1, 4	(d) 1, 3, 5, 2, 4	
2.	1. Study	2. Employment	3. Pass	4. Examination	5. Admission
	(a) 3, 5, 1, 4, 2	(b) 5, 1, 4, 3, 2	(c) 1, 2, 3, 4, 5	(d) 5, 1, 3, 4, 2	
3.	1. Plant	2. Tree	3. Soil	4. Fruit	5. Seed
	(a) 3, 4, 1, 2, 5	(b) 3, 2, 5, 4, 1	(c) 3, 5, 1, 2, 4	(d) 5, 2, 1, 4, 3	
4.	1. Income	2. Fame	3. Education	4. Employment	5. Graduation
	(a) 3, 4, 1, 2, 5	(b) 3, 5, 1, 2, 4	(c) 5, 2, 1, 4, 3	(d) 3, 5, 4, 1, 2	
5.	1. Probation	2. Interview	3. Selection	4. Appointment	5. Application
	(a) 3, 5, 1, 2, 4	(b) 5, 4, 2, 3, 1	(c) 5, 2, 3, 4, 1	(d) 5, 3, 2, 1, 4	
6.	1. Rain	2. Vaporisation	3. Water	4. Condensation	5. Cloud
	(a) 3, 2, 5, 4, 1	(b) 3, 2, 4, 5, 1	(c) 1, 3, 2, 4, 5	(d) 5, 3, 4, 1, 2	
7.	1. Travel	2. Destination	3. Reservation	4. Station	5. Packing
	(a) 3, 4, 5, 1, 2	(b) 3, 5, 1, 2, 4	(c) 5, 3, 4, 1, 2	(d) 3, 5, 4, 1, 2	

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8.	1. Ocean	2. Rivulet	3. Sea	4. Glacier	5. River
	(a) 5, 2, 3, 4, 1	(b) 4, 2, 5, 3, 1	(c) 5, 2, 3, 1, 4	(d) 4, 2, 3, 5, 1	
9.	1. Seed	2. Flower	3. Tree	4. Fruit	5. Bud
	(a) 3, 1, 4, 5, 2	(b) 1, 5, 3, 4, 2	(c) 1, 2, 3, 4, 5	(d) 1, 3, 5, 2, 4	
10.	1. Design	2. Testing	3. Implementation	4. Evolution	5. Requirement
	(a) 5, 1, 3, 2, 4	(b) 5, 1, 3, 4, 2	(c) 1, 5, 3, 2, 4	(d) 1, 5, 3, 4, 2	
11.	1. Maintenance	2. Requirement	3. Testing	4. Development	5. Deployment
	(a) 2, 4, 1, 5, 3	(b) 2, 4, 3, 5, 1	(c) 4, 2, 3, 5, 1	(d) 4, 2, 1, 5, 3	
12.	1. Egg	2. Adult	3. Caterpillar	4. Pupa	5. Butterfly
	(a) 1, 3, 4, 2, 5	(b) 1, 3, 4, 5, 2	(c) 2, 4, 5, 3, 1	(d) 1, 2, 3, 4, 5	
13.	1. Sentence	2. Chapter	3. Letter	4. Book	5. Word
	(a) 1, 5, 3, 2, 4	(b) 3, 5, 4, 2, 1	(c) 3, 5, 1, 2, 4	(d) 5, 3, 2, 4, 1	
14.	1. Cutting	2. Dish	3. Vegetable	4. Cooking	5. Eating
	(a) 4, 1, 3, 5, 2	(b) 1, 3, 4, 2, 5	(c) 3, 1, 4, 2, 5	(d) 4, 1, 2, 5, 3	
15.	1. Lucknow	2. Bhopal	3. Shimla	4. Hyderabad	5. Raipur
	(a) 3, 1, 2, 4, 5	(b) 1, 3, 2, 4, 5	(c) 3, 1, 2, 5, 4	(d) 1, 3, 5, 4, 2	
16.	1. Gold	2. Iron	3. Sand	4. Platinum	5. Diamond
	(a) 4, 5, 1, 3, 2	(b) 3, 2, 1, 5, 4	(c) 5, 4, 3, 2, 1	(d) 2, 4, 3, 5, 1	
17.	1. Conjugal	2. Infant	3. Adult	4. Child	5. Puberty
	(a) 2, 4, 3, 5, 1	(b) 2, 4, 3, 1, 5	(c) 2, 4, 5, 3, 1	(d) 5, 2, 3, 4, 1	
18.	1. Core	2. Mantle	3. Crust	4. Atmosphere	5. Mesolayer
	(a) 1, 2, 5, 3, 4	(b) 1, 5, 2, 3, 4	(c) 1, 5, 3, 2, 4	(d) 1, 2, 3, 5, 4	
19.	1. Mesosphere	2. Troposphere	3. Thermosphere	4. Stratosphere	5. Exosphere
	(a) 2, 5, 3, 1, 4	(b) 2, 4, 3, 5, 1	(c) 2, 3, 4, 1, 5	(d) 2, 4, 1, 3, 5	
20.	1. Animal	2. Catlike	3. Leopard	4. Mammal	5. Vertebrate
	(a) 1, 5, 4, 2, 3	(b) 1, 4, 3, 2, 5	(c) 1, 3, 5, 4, 2	(d) 1, 2, 3, 4, 5	
21.	1. Family	2. Community	3. Member	4. Locality	5. Country
	(a) 3, 1, 2, 4, 5	(b) 3, 1, 5, 4, 2	(c) 4, 2, 3, 1, 5	(d) 2, 4, 3, 1, 5	
22.	1. Skull	2. Shoulder	3. Neck	4. Face	5. Legs
	(a) 1, 2, 3, 4, 5	(b) 1, 4, 3, 2, 5	(c) 1, 3, 4, 2, 5	(d) 1, 4, 2, 3, 5	
23.	1. Grain	2. Plant	3. Sandwich	4. Bread	5. Dough
	(a) 1, 2, 5, 4, 3	(b) 2, 1, 4, 5, 3	(c) 2, 1, 5, 4, 3	(d) 1, 2, 3, 5, 4	
24.	1. Animal	2. Cow	3. Grass	4. Mammal	5. Milk
	(a) 4, 1, 2, 5, 3	(b) 1, 4, 2, 5, 3	(c) 1, 4, 2, 3, 5	(d) 4, 1, 2, 3, 5	
25.	1. Nectar	2. Honey	3. Bee	4. Flower	5. Wax
	(a) 4, 3, 2, 1, 5	(b) 4, 3, 1, 2, 5	(c) 3, 4, 1, 5, 2	(d) 4, 3, 5, 1, 2	
26.	1. Elephant	2. Dog	3. Butterfly	4. Tiger	5. Whale
	(a) 5, 3, 1, 2, 4	(b) 2, 5, 1, 4, 3	(c) 1, 3, 5, 4, 2	(d) 3, 2, 4, 1, 5	
27.	1. Yarn	2. Plant	3. Saree	4. Cotton	5. Cloth
	(a) 2, 4, 1, 5, 3	(b) 2, 4, 5, 1, 3	(c) 2, 4, 5, 3, 1	(d) 2, 4, 3, 5, 1	
28.	1. Police	2. Punishment	3. Criminal	4. Justice	5. Judgement
	(a) 3, 1, 2, 4, 5	(b) 3, 1, 4, 5, 2	(c) 1, 2, 3, 4, 5	(d) 4, 3, 1, 5, 2	
29.	1. Hecto	2. Centi	3. Deca	4. Milli	5. Deci
	(a) 3, 1, 5, 2, 4	(b) 3, 5, 1, 2, 4	(c) 3, 4, 1, 2, 5	(d) 1, 3, 5, 2, 4	
30.	1. Book	2. Pulp	3. Timber	4. Jungle	5. Paper
	(a) 3, 2, 5, 1, 4	(b) 4, 3, 2, 5, 1	(c) 2, 5, 1, 4, 3	(d) 5, 4, 3, 1, 2	
31.	1. Poverty	2. Population	3. Death	4. Unemployment	5. Disease
	(a) 3, 1, 4, 5, 2	(b) 3, 2, 5, 1, 4	(c) 4, 3, 2, 1, 5	(d) 3, 5, 1, 4, 2	
32.	1. Wall	2. Clay	3. House	4. Room	5. Bricks
	(a) 3, 4, 1, 2, 5	(b) 4, 3, 1, 5, 2	(c) 3, 4, 1, 5, 2	(d) 3, 4, 5, 2, 1	
33.	1. Graduation	2. High School	3. Ph.D.	4. Masters	5. Intermediate
	(a) 2, 5, 1, 4, 3	(b) 2, 5, 1, 3, 4	(c) 2, 5, 4, 1, 3	(d) 2, 5, 3, 4, 1	
34.	1. Despondent	2. Unhappy	3. Melancholy	4. Gloom	5. Sorrow
	(a) 4, 1, 3, 2, 5	(b) 3, 2, 5, 1, 4	(c) 1, 4, 2, 5, 3	(d) 1, 4, 5, 3, 2	

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35.	1. Galaxy	2. Sun	3. Moon	4. Earth	5. Star
	(a) 1, 5, 3, 4, 2	(b) 1, 3, 5, 4, 2	(c) 3, 4, 2, 1, 5	(d) 1, 5, 2, 4, 3

4.4 Coding and Decoding

Coding is the process of converting a word (or number) into another language by using letters and numbers while decoding is to convert the coded value back into the normal language. In question of this topic a word and coded form of the word (or number) will be given. It will be required to decode the logic behind this coding and then apply the logic to another given word to find the answer in form of a code. Let us consider some example:

Example [GA-2014 (2 marks)]: If 'KCLFTSB' stands for 'best of luck' and 'SHSWDG' stands for 'good wishes', which of the following indicates 'ace the exam'?
(a) MCHTX (b) MXHTC (c) XMHCT (d) XMHTC
Solution (b): If we reverse the order of phrase and exclude the English vowels then rewriting it without space we have the given two codes. So for 'ace the exam', by reversing it we get 'maxe eht eca'; after removing English vowels and rewriting it without space we get 'MXHTC'

Example [GA-2015 (1 mark)]: If ROAD is written as URDG, then SWAN should be written as:
(a) VXDQ (b) VZDQ (c) VZDP (d) UXDQ
Solution (b): If we write the alphabets from A to Z we can notice that every word is written by adding 3 to its position. For e.g. R comes at 18^{th} position in English alphabets, so adding 3 to 18 we get 21, and U comes at the 21^{st} position in English alphabets. Similarly O, A and D are replaced by R, D and G, respectively. Similarly $S+3=V$; $W+3=Z$; $A+3=D$; $N+3=Q$. Thus SWAN should be written as VZDQ.

Example [GA-2016 (1 mark)]: If 'relftaga' means carefree, 'otaga' means careful and 'fertaga' means careless, which of the following could mean 'aftercare'?
(a) zentaga (b) tagafer (c) tagazen (d) relffer
Solution (c): We notice that 'taga' and 'care' is common in all three words. Thus 'taga' means 'care'. Now, in 'relftaga' which means 'carefree', we can conclude that 'relf' means 'free'; similarly, 'o' means 'ful'; and 'fer' means 'less'. Hence the given word 'aftercare' is meant by 'care' and 'after', i.e. 'taga' and the word meant by 'after'. So we can conclude that 'aftercare' is meant by 'taga___', where the blank space is filled by the word which means 'after'. Thus options (a) and (d) are not correct. Option (b) is not correct as 'less' is meant by 'fer'. Hence we are left with option (c), which is correct and we can conclude that the word 'after' is meant by 'zen'.

Exercise 4.4

In all the following questions, a word (or number) and its coded form will be given. You have to decode the logic behind this coding and then apply the logic to another given word (or number) to find the answer in form of a code.

1. If 'ZXV' stands for 'ACE'. What will 'YZW' stand for?
(a) ABD (b) SAD (c) BAD (d) SAD

2. If 'BAD' in a certain language is coded as '514', 'GIVE' as '3068' and 'FOR' as '729', then how will 'VIDEO' be written?
(a) 60487 (b) 30214 (c) 60482 (d) 03482

3. If 'CHEMISTRY' is coded as 'NFIDITUSZ'. How is 'BEANSTOCK' coded in that code?
(a) CFBOSLDPU (b) OBFCSUPDL (c) CFBOSUPDL (d) OBFCSLDPU

4. If 'Reds' are 'blues', 'blues' are 'whites', 'whites' are 'yellows', 'yellows' are 'oranges', 'oranges' are 'pinks', then what is the colour of the sky?
(a) White (b) Yellow (c) Blue (d) Orange

5. If 'man is coded as 'woman', woman is coded as 'girl', 'girl' is coded as 'boy', 'boy' is coded as 'worker' then 10 years female is known as?
(a) Girl (b) Boy (c) Man (d) Woman

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6. If 'INDIA' is written as 'JOEJB', how would you 'SPACE' in that language?
(a) BUTQE (b) TQBDF (c) TUSQD (d) TUQED

7. In a given code SISTER is coded as 535301, UNCLE as 84670 and BOY as 129. How is 'RUSTIC' written in the code?
(a) 638749 (b) 581633 (c) 815633 (d) 185336

8. In a certain code 'Reason' is written as 621754 and 'TRUTH' as 86983. Find out the codes for 'TREASON'.
(a) 2865146 (b) 7548621 (c) 8621754 (d) 7542681

9. In a certain code, PAPER is written as SCTGW. How is 'MOTHER' written in that code?
(a) PQXKJV (b) PJGTQV (c) ORLGWV (d) POXJIT

10. If 'D' is 4 and 'BASIS' is 54, then 'COVER' is
(a) 63 (b) 60 (c) 66 (d) 57

11. If 'B' is 8 and 'CAT' is 60, then 'BAT' is
(a) 35 (b) 40 (c) 45 (d) 60

12. If cloud is called white, white is called rain, rain is called green, green is called air, air is called Green and blue is called water, where will the birds fly?
(a) Air (b) Cloud (c) Green (d) Rain

13. In a certain code, 'TWENTY' is written as '863985' and 'TWELVE' is written as '863203', how is 'ELEVEN' written in that code?
(a) 323239 (b) 323939 (c) 323930 (d) 323039

14. If rain is called water, water is called air, air is called flood, flood is called sky, sky is called river, river is called road, where do you row a boat?
(a) flood (b) road (c) river (d) air

15. In a certain code 'MUST' is written as '5131112' and 'MAT' is written as '51912', how is 'TRUST' written in that code?
(a) 1210131112 (b) 1210131212 (c) 1211131112 (d) 1210151112

16. In a certain code 'NEAR' is written as '5519' and 'MAT' is written as '412', how is 'TRACK' written in that code?
(a) 29123 (b) 21932 (c) 92132 (d) 29132

17. If 'PLANE' is written as '73155' and 'PLAIN' is written as '73195', then 'WORD' is written as
(a) 6549 (b) 5964 (c) 5694 (d) 4965

18. If 'KITE' is written as '2925' and 'TOWEL' is written as '26553', then 'TRIM' is written as
(a) 4992 (b) 2994 (c) 9492 (d) 9429

19. If 'White' is written as 'EHIBE' and 'BLUE' is written as 'BCCE', then 'GREEN' is written as
(a) GEIEE (b) EGIEE (c) IGEEE (d) GIEEE

20. If 'INDIA' is written as 'IEDIA' and 'CHINA' as written as 'CHIEA', then 'BURMA' is written as
(a) BCDIA (b) CDIAB (c) ABCDI (d) BCIDA

21. In a certain code language, 'dom pul ta' means 'bring hot coffee'; 'pul fir sop' means 'coffee is good' and 'tak da sop' means 'good bright boy', which of the following does mean 'hot' in that language?
(a) dom (b) pul (c) ta (d) data insufficient

22. In a certain code 'il be pee' means 'roses are good', 'sik hee' means 'yellow flowers' and 'pee mit hee' means 'flowers are leaves', How is 'yellow' written in that code?
(a) hee (b) sik (c) be (d) data insufficient

23. In a certain code language: 'dugo hui mul zo' stans for 'work is very hard' 'hui dugo ba ki' for 'He is very intelligent'; 'nano mul dugo' for 'wood is hard'; and 'mul ki gu' for 'intelligent and hard' Which of the following word stand for 'He'?
(a) ba (b) dugo (c) ki (d) data insufficient

24. In a certain code language 'pit nae tom' means 'apple is red', 'nae ho tap' means 'red and blue' and 'ho tom ka' means 'shirt is blue'. Which of the following represents 'apple' in that language?
(a) nae (b) ka (c) pit (d) data insufficient

25. If 'nitco sco tingo' stands for 'softer than flower'; 'tingo rho mst' stands for 'sweet flower smell' and 'mst sco tmp' stands for 'sweet than girl' what would 'smell' stand for?
(a) rho (b) mst (c) sco (d) data insufficient

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26. In a certain code language, '148' means 'Apples are good', '651' means 'Eat good food' and '284' means 'Apples are ripe'. Which digit means 'ripe' in that language?
(a) 1 (b) 4 (c) 2 (d) data insufficient

27. In a certain code, '147' means 'spread white bed-sheet'; '158' means 'dust one bed-sheet' and '134' means 'one white bed-sheet' which digit in that code means 'dust'?
(a) 8 (b) 3 (c) 5 (d) data insufficient

28. In a certain code language, '134' means 'good and tasty', '473' means 'file good pictures' and '729' means 'pictures are faint'. Which of the following digits stands for 'file'?
(a) 4 (b) 3 (c) 7 (d) data insufficient

29. In a certain code '153' means 'clothes are old', '546' means 'man is old' and '378' means 'buy good clothes'. What stands for 'are' in that code?
(a) 1 (b) 4 (c) 7 (d) data insufficient

30. In a certain code '314' means 'how are you', '734' means 'where are you'. What will be the code for 'where'?
(a) 1 (b) 4 (c) 7 (d) data insufficient

31. If 'EAEI' stands for 'bring me water' and 'EIIEA' stands for 'water is life', which of the following indicates 'life and death'?
(a) AEAEI (b) AEAIE (c) EAAEI (d) IEAEA

32. If 'DGSGNR' stands for 'orange is good' and 'HGHTSC' stands for 'cost is high', which of the following indicates 'house is good'?
(a) HSSGD (b) DGSSH (c) GDSSH (d) SDGHS

33. If 'modern games history' is coded as 'IHN', and 'dogs are barking' is coded as 'CBE', then which of the following indicates 'summer Olympic games'?
(a) HPT (b) GMT (c) TPH (d) TMG

34. If 'dogs are barking' is coded as 'AZC' and 'dogs and horses' is coded as 'GZC', then which of the following indicates 'donkeys are mad'?
(a) CZL (b) DAM (c) MAD (d) LZC

35. If 'good jokes' is coded as 'GKDJS' and 'some real stories' is coded as 'SRTSLRMS', then which of the following indicates 'many good stories'?
(a) SRTSDGYNM (b) MTSRDGYNS (c) MRTSDGYNS (d) MRTSGDYNS

4.5 Situation and its Reaction

Situation reaction problem is a Psychology test. These types of problems is mainly to judge a candidate's ability to use his presence of mind to tackle a given situation, he may come across anytime in life.

Example: While coming back to your home, you found wallet lying on the road. You would
(a) give the money to your friend
(b) hand it over to the traffic police
(c) try to find his/her contact number and inform the owner
(d) leave the wallet as it is
Solution (c): If you are an honest person then, you will try to find his/her contact number and inform the owner of the wallet. So, that wallet will be reached in right hands. So option (c) is our answer.

Exercise: 4.5
Choose the best response which shall present you as a good person or a sincere professional.

1. **While travelling in a train, you observe some college students pulling the alarm chain simply to get down at their desired location. You would**
   (a) stop them from doing so with the help of some passengers
   (b) let them pull the chain and call to the railway police
   (c) inform the ticket checker of the train as soon as it stops
   (d) keep quiet and do nothing
2. **You want to get married to a person of your choice, but your family members want that you should marry a person of their choice. You would**

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(a) do what your family says (b) marry the person of your choice
(c) not marry to anyone (d) try to convince your family about your choice

3. "No risk no loss", you
(a) feel that risk means no profit
(b) believe that this statement is correct
(c) decided that in life the risk should not be taken
(d) fell that risk may be taken only after analysing the situation completely

4. Some of your friends are drinking beer at the party and they are influencing you to do the same. You will
(a) take only quarter glass of beer (b) refuse to take beer
(c) refuse and lie to them that you have stomach ache (d) take a glass of beer

5. You missed your school bus and getting late for school. In such a situation, you
(a) go back to your home (b) start walking towards your school
(c) think about other possible convenience (d) go to watch movie in cinema hall

6. If you are HR manager of a company. For two vacancies, there are four candidates; one out of them is your nephew. You would
(a) select your nephew though he is not eligible for the post
(b) select you nephew only if he is eligible
(c) select your nephew only if he is more eligible than other two candidates
(d) tell the candidates that vacancy is already fulfilled

7. Your college has organised a blood donation camp. You should
(a) convince your friends to donate it
(b) firstly donate your blood and then convince your friends to donate it
(c) donate your blood at the camp
(d) do not believe in donating blood and decide not to attend

8. Your servant has invited you to her daughter's wedding. You would
(a) completely ignore her (b) attend the wedding with your family
(c) buy a gift for her daughter (d) attend the wedding yourself only

9. One of your colleague is not working properly, you would
(a) file a complaint to your boss (b) do his work
(c) try to develop his interest in his work (d) talk to him and try to find out his problem

10. You are selected for your first job in four companies. You will join that company
(a) which offers highest salary (b) which gives you chance to go abroad
(c) where you can utilize your skills (d) which assures the job cannot be snatched from you

11. When you get angry, you usually
(a) leave your house (b) start beating your younger ones
(c) start consuming alcohol (d) leave the situation and engage yourself in a different activity

12. Your relative has not invited you to his birthday party. You will
(a) send him your best wishes (b) ignore the situation
(c) attend his party with a gift (d) attend his party without a gift

13. You find that your partner has been cheating on you. You will
(a) break relation with him/her (b) also try to make extramarital affair
(c) tell your relatives about the situation (d) make realise to your partner for his/her mistake

14. You are not selected for the college cricket team. You should
(a) again practiced hard and got selected in next trial (b) fight with the selection team
(c) practiced hard for another football (d) stop playing cricket

15. The smartphone that you got as a present from your friend was defective. You should
(a) inform about the situation to your other friends (b) ask to your friend if it has warranty
(c) demand for other smartphone (d) forget about the situation

16. Your colleagues generally disagree with you. You should
(a) avoid your colleagues (b) find reasons of it and review yourself
(c) change your company (d) complain to your boss about your colleagues behaviour

17. Your neighbour's house had leaked in winter and his family has fallen sick. You should
(a) took them to hospital for treatment (b) not to worry about them
(c) call the ambulance (d) check whether your house is not leaking

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18. On trekking your friend slipped in a ditch. You should
(a) continue with your trekking
(b) quickly roll down to him, throw a rope toward him and bring him to a safer place
(c) shout for help
(d) also slipped in the same ditch to give him company

19. You are not able to do well in your examination. You should
(a) go to your teacher and request for more marks
(b) not worry about the result
(c) analyse and then improve your weakness and do well in next examination
(d) go to your teacher and request to change his/her teaching method

20. Your step mother was always rebuking and cursing you. You should
(a) never talk to her
(b) never help her in any work
(c) complain to your father
(d) never got serious to her words

21. A night before the one act play in which you are hero, you fell ill. You should
(a) forget about the play
(b) took medicine and practice for the play
(c) took medicine and lie on the bed
(d) took medicine

22. You are walking on the road side and saw two guys were teasing a girl. You should
(a) take the help of other people on the road to caught the guys and handover to the police
(b) join the guys because you hate that girl
(c) not think about the two guys as you are getting late to meet your friend
(d) not join the guys because you hate that girl

23. The pocket money you got was not sufficient. You should
(a) fight with your parents
(b) explain the requirement to your parents and request them to increase the pocket money
(c) request them to increase the pocket money
(d) request them to increase the pocket money as your friends receive more than you

24. You fall seriously ill just before final exam. You should
(a) take medicine as you have to appear in the exam next day
(b) take medicine and requesting your parents for not appearing in the exam
(c) not take medicine because you know you are going to fail in the exam
(d) not take medicine and requesting your parents for not appearing in the exam

25. You are driving your car and you hit against a fruit vendor's cart. You should
(a) escape from the site by driving away
(b) insult the fruit vendor for putting his cart on the way
(c) pay the fruit vendor for the damage done to him
(d) insist that it was not your fault

26. In your hostel mess you notice the dal has had some stones. You should
(a) bring the matter to the notice of the authorities in charge
(b) not eat the dal
(c) angry on the mess staff
(d) demand for the suspension of the mess staff who cooked the dal

27. You are standing in the doorway of a train which has just started to move, suddenly you see a man falling off the train to the platform. You should
(a) take your seat
(b) run immediately and help the man to get on the train with all effort
(c) tell your friend about the incident
(d) watch whether the man gets on the train or not

28. You see in a deserted bazar a man who smashes the jeweller's window and steals some ornament, jump into the car and drive away quickly. You should
(a) stop the vehicles passing by
(b) note the number of the car, inform the jeweller
(c) note the number of the car, inform police immediately by phone
(d) shout for help

29. The electric lights of your area have gone out due to heavy rain. You should
(a) go out with your friends and enjoy the evening

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(b) ignore the situation
(c) inform the power house from the nearest telephone for restoration of electricity
(d) wait for restoration of electricity

30. While travelling by train, you come to know on the next station from which you boarded that you have lost your ticket. You should
(a) go to the toilet room and hide there
(b) hide under the lower berth
(c) not worry about the situation because you think when ticket checker will come he will make another ticket
(d) report it to the ticket checker and do whatever he advice

31. You have joined an educational institute which is far from home. You are happy because
(a) you will learn to live independently
(b) you can do all the things which are not done at home
(c) here is no one who can control your thoughts
(d) you can meet with you friends anytime

32. Being invited to a party of a 7 year old kid of neighbour, what will you do?
(a) Buy picture storybook, crayons as a present (b) Buy a laptop
(c) Buy a smartphone (d) Buy a dress

33. In any discussion you always win an argument, what do you think is the reason?
(a) I am good looking, smart, dashing and daring person
(b) I have completed my Masters from abroad
(c) I can influence others with my points and give practical and sounds reasons to agree to it
(d) I am the only son of a billionaire

34. When you see somebody in your school/college/workplace who is much more successful and is a favourite of all, you should
(a) politely say that the person was great
(b) feel jealous
(c) send him your best wishes and continue with your work
(d) appreciate the person and take and learn as much good points from that person

35. You are very successful any have many jealous people who you suspect are planning against you. You should
(a) keep doing your work with more caution and alertness
(b) keep doing your work as before
(c) not take part in any activity in which the jealous people are participating
(d) make a distance with the jealous people

4.6 Odd One Out

In these type of question, some group of letters or words or pairs, etc. shares a common similarity while one is different, which we have to find. Let us consider an example.

Example: Find the odd one out (a) Crusade (b) Expedition (c) Cruise (d) Campaign
Solution (c): Cruise is a sea voyage for pleasure. All other given words are related to journey on land or sea with an aim. So option (c) is the odd one out.

Example: Find the odd one out
(a) Circle: Arc (b) Chair: Leg (c) Flower: Petal (d) Cover: Page
Solution (d): Arc is a part of a circle; Leg is a part of chair; Petal is a part of a flower. But we cannot say that page is a part of a cover. So the pair given on option (d) is the odd one.

Example [GA-2016 (1 mark)]: Find the odd one in the following group of words: **mock, deride, praise, jeer**
(a) mock (b) deride (c) praise (d) jeer
Solution (c): 'mock, deride, and jeer' all means 'to laugh at someone'; on the other hand, 'praise' means 'to express admiration or approval about the achievements or characteristics of a person or thing'. Hence the odd one from the given words is 'praise'.

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Exercise: 4.6

In each of the following questions, the words or pair of words is given, all of which, except one, share a common similarity. You have to choose which one is different.

1.	(a) Ginger	(b) Garlic	(c) Chilli	(d) Potato
2.	(a) Banana	(b) Papaya	(c) Apple	(d) Orange
3.	(a) Owl	(b) Eagle	(c) Hawk	(d) Corellas
4.	(a) Ball	(b) Cylinder	(c) Globe	(d) Sphere
5.	(a) Den	(b) House	(c) Burrow	(d) Nest
6.	(a) Rose	(b) Lotus	(c) Jasmine	(d) Dahlia
7.	(a) Mother	(b) Father	(c) Friend	(d) Wife
8.	(a) Mew	(b) Hiss	(c) Bark	(d) Shout
9.	(a) Cow	(b) Deer	(c) Horse	(d) Rhinoceros
10.	(a) Raid	(b) Attack	(c) Defence	(d) Ambush
11.	(a) Arc	(b) Diagonal	(c) Radius	(d) Chord
12.	(a) Epicentre	(b) Seismology	(c) Hollow	(d) Richter Scale
13.	(a) Ear	(b) Lung	(c) Kidney	(d) Heart
14.	(a) Canoe	(b) Igloo	(c) Yacht	(d) Raft
15.	(a) Physics	(b) Chemistry	(c) Botany	(d) Geography
16.	(a) Door : Bang	(b) Piano : Play	(c) Drum : Beat	(d) Rain : Platter
17.	(a) Profit : Loss	(b) Wise : Foolish	(c) Virtue : Vice	(d) Seduce : Attract
18.	(a) Aphid : Paper	(b) Moth : Wool	(c) Termite : Wood	(d) Locust : Plant
19.	(a) Cow : Calf	(b) Dog : Bitch	(c) Lion : Cub	(d) Tortoise : Turtle
20.	(a) Beans : Pulse	(b) Rice : Cereals	(c) Tea : Beverage	(d) Peas: Nodules
21.	(a) Fish : Shoal	(b) Cow : Herd	(c) Sheep : Flock	(d) Man : Mob
22.	(a) Mercury : Sun	(b) Moon : Earth	(c) Wheel : Axle	(d) Star : Galaxy
23.	(a) Hard : Soft	(b) Long : High	(c) Sweet : Sour	(d) Pointed : Blunt
24.	(a) Car : Road	(b) Ship : Sea	(c) Rocket : Space	(d) Aeroplane : Pilot
25.	(a) Rice : Corn	(b) Tomato : Potato	(c) Student : Class	(d) Book : Library
26.	(a) Shoe : Laces	(b) Neck : Tie	(c) Wrist : Band	(d) Waist : Belt
27.	(a) Oil : Lamp	(b) Water : Tap	(c) Oxygen : Life	(d) Power : Machine
28.	(a) Ice : Cold	(b) Iron : Hard	(c) Purse : Money	(d) Marble : Smooth
29.	(a) Stale : Fresh	(b) Truth : Lie	(c) Slow : Sluggish	(d) Teach : Learn
30.	(a) Pelican : Reptile	(b) Gnu : Antelope	(c) Elk : Deer	(d) Shark : Fish
31.	(a) Broom : Sweep	(b) Spoon : Feed	(c) Nut : Crack	(d) Soap : Bath
32.	(a) Flurry : Blizzard	(b) Moisten : Drench	(c) Prick : Stab	(d) Scrub : Polish
33.	(a) Army : General	(b) Team : Captain	(c) Adult : Infant	(d) State : Minister
34.	(a) Metal : Ore	(b) Ghee : Milk	(c) Gasoline : Petrol	(d) Soil : Earth
35.	(a) Death : Disease	(b) Milk : Butter	(c) Grape : Wine	(d) Water : Oxygen

4.7 Verification of the Truth of the Statement

In these type of problems, four possible options are given and we have to choose one which is always associated with the given thing or word or statement. Let us consider an example:

Example: Which of the following an animal always has?
(a) Lungs (b) Skin (c) Heart (d) Life
Solution (d): We know that without 'life' the lungs, skin, heart have no value for an animal. So the animal always has life.

Exercise 4.7

Choose the most appropriated option which is always associated with the given thing or word or statement.

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1. A cricket match always has
(a) victory (b) players (c) prize (d) rivals
2. A book always has
(a) figures (b) problems (c) pages (d) contents
3. A river always has
(a) Delta (b) fishes (c) boats (d) banks
4. A jail always has
(a) Locks (b) jailor (c) bars (d) prisoners
5. An oasis always has
(a) Forest (b) water (c) travellers (d) sand
6. An electric bulb always has
(a) current (b) glass (c) filament (d) light
7. A scenery always has
(a) painter (b) composition (c) river (d) mountains
8. A pen always has
(a) Nib (b) cap (c) tube (d) ink
9. A dead body have no
(a) sensation (b) breathing (c) movement (d) heart-beats
10. A living person always have
(a) Teeth (b) hair (c) eyes (d) heart
11. Danger always involves
(a) Enemy (b) attack (c) fear (d) help
12. A mountain always has
(a) Peak (b) snow (c) tress (d) valley
13. Milk always contains
(a) Water (b) sugar (c) calcium (d) vitamin
14. Controversy always involves
(a) disagreement (b) appetite (c) inequality (d) aversion
15. Quilt always has
(a) cotton (b) shelter (c) duplication (d) labels
16. A flower always have
(a) mud (b) petals (c) root (d) rainwater
17. A man always have
(a) wife (b) son (c) daughter (d) father
18. All animals have
(a) ears (b) horns (c) instincts (d) legs
19. A song always has
(a) music (b) chorus (c) word (d) singer
20. Which of the following is associated with diamond?
(a) use (b) brilliance (c) hardness (d) design
21. A factory always has
(a) raw-material (b) workers (c) designers (d) electricity
22. A shoe always has
(a) design (b) brightness (c) leather (d) sole
23. Which of the following is always associated with 'Justice'?
(a) Pretence (b) Nobility (c) Legitimate (d) Diminutiveness
24. Which of the following is always found in 'Bravery'?
(a) courage (b) knowledge (c) command (d) awareness
25. Which of the following is always associated with 'Bargain'?
(a) extravagance (b) exchange (c) frippery (d) fluency
26. Taj is in Agra; Agra is in India. Therefore, the Taj is in India.
(a) Always (b) Sometimes (c) Never (d) Often
27. People who are bald are generally of the intellectual type. Ramesh is bald. Therefore, Ramesh is an intellectual person.
(a) True (b) False (c) Probably true (d) Can't say

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28. Hydrogen is lighter than Carbon. Hydrogen is lighter than helium. Therefore, Carbon is the heaviest of the three gases.
(a) True (b) False (c) Probably true (d) Can't say

29. Which one of the following is always found in 'Wonder'?
(a) troop (b) burden (c) astonishment (d) bucolic

30. Disclosure always involves
(a) causes (b) show (c) clarification (d) secrets

31. Which of the following is always found in 'Remedy of fault'?
(a) penalty (b) remedy (c) fault (d) caution

32. My 15 year old niece is taller than my 20 year old son.
(a) always (b) never (c) often (d) sometimes

33. Yesterday I saw my ice cream was melted due to heat of a nearby stove.
(a) always (b) never (c) often (d) sometimes

34. You are sitting in the middle of a bus. When the driver suddenly accelerates the bus in forward direction you experience a backward force?
(a) always (b) never (c) often (d) sometimes

35. Management always involves
(a) regulation (b) advise (c) encouragement (d) compulsion

4.8 Statement and Assumption

When we see clouds in the sky; we take pre-assumption that it may be rain. Each action has an assumption one in positive and another in negative. Let us suppose a baby born it may be a boy or a girl. So, here we take two assumptions. The candidate will be required to assess the given statement and decide which of the given assumptions is implicit in the Statement. To understand the pattern of these questions, it is very essential to know what the terms Statement and Assumptions do stand for.
Hence, "An assumption is something that can be supposed or assumed on the basis of a given statement." Let us consider an example:

Example: **Statement:** In spite of heavy rains, rail services did not get disrupted this year.
Assumption I: Rail services get disrupted only in rainy season.
Assumption II: Heavy rains normally affect the rail services.

Solution: Assumption I is not implicit as rail services may be disrupted due to many reasons. Assumption II is implicit as heavy rains destroy the track due to which rail services may be disrupted.

Exercise 4.8

In each question below a statement is followed by assumptions. You have to consider the statement and the following assumptions and then decide which of the assumptions is implicit in the statement and choose the correct option from the given options.

1. **Statement:** To secure a first rank in the examination you have to work very hard.
Assumption I: Getting first class in the examination is desirable.
Assumption II: Hard work results in success.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Either assumption I or II is implicit (d) Both assumptions I and II are implicit

2. **Statement:** All the teachers are hereby instructed to reach the institute by 9 AM.
Assumption I: Some of the teachers do not arrive at the institute in time.
Assumption II: Teachers will follow the strict warning given in the notice.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Either assumption I or II is implicit (d) Neither assumption I nor II is implicit

3. **Statement:** It is through participative management policy alone that indiscipline in our industries can be contained and quality of life ensured to the workers.
Assumptions I: Quality of life in our industry is better.
Assumption II: Indiscipline results in poor quality of life.

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(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Either assumption I or II is implicit (d) Neither assumption I nor II is implicit

4. **Statement:** The chairman and secretary of the housing society have requested society members to use water economically to help society to save on water-tax.
Assumptions I: Majority of members of the society are likely to follow the request.
Assumptions II: It is desirable to reduce expenditure whenever possible.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
5. **Statement:** The private bus services in the city have virtually collapsed because of the on-going strike of its employees.
Assumptions I: Going on strike has become the right of every employee.
Assumption II: People no more require the services of private bus operators.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
6. **Statement:** An advertisement of a bank "Want to open a bank account! Just dial our 'room service' and we will come at your door steps."
Assumptions I: There is a section of people who require such service at their home.
Assumption II: Nowadays banking has become very competitive.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
7. **Statement:** Whenever you have any doubt on this subject you may refer to the book by XYZ.
Assumptions I: The book by XYZ is available.
Assumption II: There is no other book on this subject.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
8. **Statement:** Dereliction of duty and indiscipline have come to stay in this organisation.
Assumptions I: Organisation is what the employees are
Assumption II: Employees are expected to do their duty.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
9. **Statement:** The programme will start at 6 pm. but you can come there upto 7 pm or so and still there is no problem.
Assumptions I: The programme will continue even after 7 pm.
Assumption II: The programme may not start by that time.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
10. **Statement:** The entry of multinational companies in India has led to higher efficiency of the Indian Companies who are competing with them.
Assumptions I: Employees of multinationals may serve as models for Indian Company's employees.
Assumption II: Competition may reduce many Indian companies to ashes.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
11. **Statement:** The higher echelons of any organisation are expected to be models of observational learning and should not be considered as merely sources of reward and punishments.
Assumptions I: Employees are likely to be sensitive enough to learn by observing the behaviour of their bosses.
Assumption II: Normally bosses are considered as sources of reward and punishment.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit
12. **Statement:** The Union Government has decided to withdraw existing tax relief on various small savings schemes in a phased manner to augment its tax collection.
Assumption I: People may still continue to keep money in small savings schemes and also pay taxes.
Assumption II: The total tax collection may increase substantially.

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(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit

13. Statement: The Government has decided to allow the shopping complexes to remain open till midnight to reduce crowding of shoppers in these complexes during the weekends.
Assumptions I: People may still prefer to shop during the weekends.
Assumption II: Many people may now do their shopping illusively during the late evening hour.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit

14. Statement: Majority of the students appearing for XII board examination have taken home tuition.
Assumptions I: Home tuition is the best method of learning
Assumptions II: There is a shortage of quality home tutors
(a) Either assumption I or II is implicit (b) Only assumption II is implicit
(c) Only assumption I is implicit (d) Neither assumption I nor II is implicit

15. Statement: The patient's condition would improve after operation.
Assumption I: The patient can be operated upon in this condition
Assumption II: The patient cannot be operated upon in this condition
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

16. Statement: The government has decided to disinvest large chunk of its equity in selected public sector undertaking for a better fiscal management.
Assumption I: The amount generated out of the disinvestments process may reduce substantially the mounting fiscal deficits.
Assumption II: There will be enough demand in the market for the shares of these undertakings
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

17. Statement: All existing inequalities can be reduced, if not utterly eradicated, by action of government or by revolutionary change of government.
Assumption I: Inequality is a man-made phenomenon.
Assumption II: No person would voluntarily part with what he possesses.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

18. Statement: Incentives must be given to strengthen the motivation of the employees.
Assumption I: Incentives are expected to motivate the employees.
Assumption II: Employees at present are not motivated
(a) Neither assumption I nor II is implicit (b) Only assumption II is implicit
(c) Only assumption I is implicit (d) Both assumptions I and II are implicit

19. Statement: The integrated steel plants in India would no longer have to depend on imports for continuous casting refractories.
Assumption I: Continuous casting refractories are needed by India.
Assumption II: Continuous casting refractories are in demand.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

20. Statement: "If you are beautiful, we will catch your beauty. If you are not, we will make you beautiful". An advertisement of a photo studio.
Assumption I: How to look beautiful is a problem of youngsters?
Assumption II: Nobody desires to be beautiful.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

21. Statement: Equality of income throughout a community is the essential condition for maximising the total utility which the total income available could confer on the members of that community.
Assumption I: If extra income were taken from the rick and given to the poor, the total utility experienced by the community would increase.
Assumption II: Equal pay for equal work.
(a) Only assumption I is implicit (b) Only assumption II is implicit

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(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

22. Statement: Dengue cannot be eradicated from our city unless we create a special 'Health-squad' for it.
Assumption I: Dengue is harmful.
Assumption II: Creating Health-squad is impossible.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

23. Statement: A good system of education in a country is the flower of economic development; it is also its seed.
Assumption I: Economic development leads to educational development in a country.
Assumption II: Educational development leads to economic development in a country.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

24. Statement: There is one thing as important as studying; and that is how much is understood.
Assumption I: Studying and understanding go hand in hand.
Assumption II: Understanding is as important as studying.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

25. Statement: All the employees are notified that the organisation will provide transport facilities at half the cost from the nearby railway station to the office except those who have been provided with travelling allowance.
Assumption I: Most of the employees will travel by the office transport.
Assumption II: Those who are provided with travelling allowance will not read such notice.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Neither assumption I nor II is implicit (d) Both assumptions I and II are implicit

26. Statement: The residents of the locality wrote a letter to the Corporation requesting to restore normalcy in the supply of drinking water immediately as the supply at present is just not adequate.
Assumption I: The Corporation may not take any action on the letter.
Assumption II: The municipality has enough water to meet the demand.
Assumption III: The water supply to the area was adequate in the past.
(a) Both I and III are implicit (b) Both II and III are implicit
(c) Only III is implicit (d) Neither I nor II nor III is implicit

27. Statement: "Graduate with first class are eligible to apply for the admission to M.Tech. courses in our institute". An advertisement by one of IITs.
Assumptions I: Only those who are first class graduates can be up with the studies for M.Tech. courses.
Assumption II: There are plenty of first class graduates who are likely to apply for admission to M.Tech.
Assumption III: Reputation of the institute may get affected, if students having less than first class are admitted.
(a) Only I is implicit (b) Only II is implicit
(c) Only III is implicit (d) Only I and II are implicit

28. Statement: The Company has decided to increase the price of all its products to tackle the precarious financial position.
Assumptions I: The company may be able to wipe out the entire loses incurred earlier by this decision.
Assumption II: The buyers may continue to buy its products even after its increase.
Assumption III: The company has adequate resources to continue production for few more months.
(a) Only II and III are implicit. (b) Only I and II are implicit.
(c) Only II is implicit. (d) Neither I nor II nor III is implicit

29. Statement: "We must be prepared to face any eventuality and all the assignment must be completed as per their schedule". Director tells the faculty members.
Assumption I: There is a possibility of a serious eventuality.

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Assumption II: Dates are fixed for all the assignments.
Assumption III: Faculty members are supposed to complete all the assignment.
(a) Only I is implicit (b) Only III is implicit
(c) All are implicit (d) None is implicit

30. Statement: The State Government has unilaterally increased by 5% octroi on all commodities entering into the state without seeking approval of the Central Government.
Assumptions I: The State Government may be able to implement its decision.
Assumption II: The Central Government may agree to support the State Government's decision.
Assumption III: The State Government may be able to earn considerable amount through the additional octroi.
(a) Both I and II are implicit (b) Both II and III are implicit
(c) All are implicit (d) None is implicit

31. Statement: If you desire to enjoy the best holidays to Asia join our exclusive ASIA package". An advertisement of a travel agency in an American newspaper.
Assumption I: Many Americans travel of Asian countries to spend their holidays
Assumption II: These are other travel agencies in America which organize holiday tour to Asia
Assumption III: Many people may still travel to Asia through other travel agencies
(a) Only I and II are implicit (b) Only I is implicit
(c) Only I and III are implicit (d) All are implicit

32. Statement: Ashok decided to leave office at 5.00 p.m. to catch a flight to Banglore departing at 7:00 PM.
Assumptions I: The flight to Bangalore may be delayed.
Assumption II: He may be able to reach airport well before 7:00 PM
Assumption III: He may get adequate time to search for a vehicle to go to the airport.
(a) Both I and II are implicit (b) Both II and III are implicit
(c) All are implicit (d) None is implicit

33. Statement: Students of school 'X' must get a better education than students at the school 'Y' because the grade point average of the students at school 'X' is higher.
Assumptions I: The average grade earned by students is a good measure of the quality of education that a student gets.
Assumption II: Extracurricular activities at the school X are given more emphasis than at the school Y.
Assumption III: The grading standards at the two high schools are roughly the same.
(a) Both I and III are implicit (b) Both II and III are implicit
(c) All are implicit (d) Both I and II are implicit

34. Statement: In view of the recent spurt in sugar prices in the open market, the government has asked the dealers to release a vast quantity of imported sugar in the open market.
Assumption I: The dealers will follow the government directives.
Assumption II: The sugar prices will come down.
Assumption III: The price of indigenous sugar will remain unchanged.
(a) Both I and II are implicit (b) Both I and III are implicit
(c) Both II and III are implicit (d) All are implicit

35. Statement: In recently held All India Commerce Conference, the session on 'Management of Service Sector in India' surprisingly attracted large number of participants and also received very good media coverage in the leading newspaper.
Assumption I: People were not expecting such an encouraging response for service sector.
Assumption II: Service sector is not managed properly in India
Assumption III: Media is always very positive towards service sector.
(a) Both I and II are implicit (b) Both I and III are implicit
(c) Both II and III are implicit (d) All are implicit

4.9 Statement and Conclusion

In these types of questions a statement is given followed by some conclusions. The student is required to go through the statements meticulously and then decide which of the given conclusion/s follows on its basis. A conclusion is a belief or an opinion that is the result of reasoning out a given statement. It

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can also be defined as a proposition in an argument to which other propositions in the argument given support. What we exactly to do solve these questions is, understand the statement which is given and then start deducing the possible things which can be understood from the statement given. Let us consider an example:

Example: **Statement:** India's economy depends primarily on forests.
Conclusion I: Trees are to be preserved to foster India's economic development.
Conclusion II: India only has to preserve forests for growth in economy.
Solution: From the statement we can understand: (a) Trees are important for Indian Economy. (b) Forests contribute a major part in Indian Economy. (c) For Development of economy, we need to preserve forests. Now conclusion I says that, Trees are to be preserved to foster India's economic development, which is same as point (c). Therefore, it is same as what we have concluded, therefore, conclusion I is correct and will follow. Conclusion 2 says that, India only has to preserve forests for growth in economy. See, the statement indicates that Indian economy mainly depends on forests but it does not say it only depends on forests. So preserving "ONLY" forests for growth of economy cannot be deduced. Therefore, conclusion 2 will not follow.

Example [GA-2016 (1 mark)]: Fact: **If it rains, then the field is wet.** Read the following statements:
(i) It rains (ii) The field is not wet (iii) The field is wet (iv) It did not rain
Which one of the options given below is **NOT** logically possible, based on the given fact?
(a) If (iii), then (iv) (b) If (i), then (iii) (c) If (i), then (ii) (d) If (ii), then (iv)
Solution (c):
For option (a): If the field is wet, then it did not rain; can be possible because of moisture the field.
For option (b): If it rains, then the field is wet; which is true because of given fact.
For option (c): If it rains, then the field is not wet; which is not possible, **so option (c) is correct**.
For option (d): If the field is not wet, then it did not rains; which is true.

Example [GA-2016 (1 mark)]: R2D2 is a robot. R2D2 can repair aeroplanes. No other robot can repair aeroplanes. Which of the following can be logically inferred from the above statements?
(a) R2D2 is a robot which can only repair aeroplanes.
(b) R2D2 is the only robot which can repair aeroplanes.
(c) R2D2 is a robot which can repair only aeroplanes.
(d) Only R2D2 is a robot.
Solution (b): The last sentence '**No other robot can repair aeroplanes**' leads to option (b) which is best inferred as comparison to other options. So option (b) is correct.

Example [GA-2016 (2 marks)]: Consider the following statements relating to the level of poker play of four players P, Q, R and S.
I. P always beats Q II. R always beats S
III. S loses to P only sometimes IV. R always loses to Q
Which of the following can be logically inferred from the above statements?
(i) P is likely to beat all the three other players
(ii) S is the absolute worst player in the set
(a) (i) only (b) (ii) only (c) (i) and (ii) (d) neither (i) nor (ii)
Solution (a): Based on the statements I, II and IV, which gives 'P always beats Q', 'Q always beats R'; 'R always beats S', so following hierarchy can be draw P, Q, R, S (from top to bottom). Hence we conclude that P is more likely to beat other three Q, R and S. Thus statement (i) follows. On the other hand, statement (ii) does not follow because in statement III no absolute comparison of P and S is given. So option (a) is correct.

Example [GA-2016 (2 marks)]: All hill-stations have a lake. Ooty has two lakes. Which of the statement(s) below is/are logically valid and can be inferred from the above sentences?
(i) Ooty is not a hill-station. (ii) No hill-station can have more than one lake.
(a) (i) only (b) (ii) only (c) both (i) and (ii) (d) neither (i) nor (ii)

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Solution (d): The first sentence '**All hill-stations have a lake**' means 'all hill-stations have at least one lake', so a hill-station can have more than one lake, thus statement (ii) is not correct. The second sentence '**Ooty has two lakes**' so Ooty is a hill-station, hence statement (i) is not correct. Hence option (d) is correct.

Exercise 4.9

In each question below a statement is followed by conclusions. Consider the statement and the following conclusions. Decide which of the conclusions follows from the statements and choose the correct option from the given options.

1. **Statement:** It has been reported by one of the TV channels that the answer scripts of board examination of one state have been evaluated by students studying in the same standard with the help of model answers provided by the paper-setters.
   Conclusion I: All such officials/evaluators who have been a part of this malpractice should be seriously dealt with.
   Conclusion II: The board should explore the possibilities of getting these answer books evaluated by computerized machines.
   (a) Only conclusion I follow (b) Only conclusion II follow
   (c) Neither conclusion I nor II follow (d) Both conclusion I and II follows
2. **Statement:** There has been a significant drop in the water level of all the water level of all the water-bodies supplying water to the metro city Mumbai.
   Conclusion I: The water supply authority should continue to impose a partial cut in water supply to the consumers till the situation eases out.
   Conclusion II: The government should appeal to all the residents through mass media for the minimal use of water.
   (a) Only conclusion I follow (b) Only conclusion II follow
   (c) Neither conclusion I nor II follow (d) Both conclusion I and II follows
3. **Statement:** The weather department has forecast a warning that a strong cyclonic storm will hit coastal Andhra Pradesh and Orissa in the next 48 hours.
   Conclusion I: The local administration should soon send a message that all fisherman of that area avoid going deeper into the sea.
   Conclusion II: Local administration should alert the people of coastal areas of both the states to move to safer places and administrative machinery should get ready for meeting out this eventually.
   (a) Only conclusion I follow (b) Only conclusion II follow
   (c) Neither conclusion I nor II follow (d) Both conclusion I and II follows
4. **Statement:** The brave and alert villagers of Kandli village caught a group of dreaded dacoits armed with very sophisticated weapons and handed them over to the police.
   Conclusion I: The villagers of Kandii village be provided sophisticated weapons to repeat this type of act of bravery in future.
   Conclusion II: The villagers should be rewarded for their courage and unity.
   (a) Only conclusion I follow (b) Only conclusion II follow
   (c) Neither conclusion I nor II follow (d) Both conclusion I and II follows
5. **Statement:** The Reserve Bank of India has, on 20.03.2010, increased the Repo Rate by 25 basis points to 50.
   Conclusion I: This will surely anchor inflation.
   Conclusion II: The bank will now raise the lending and deposit rates.
   (a) Only conclusion I follow (b) Only conclusion II follow
   (c) Neither conclusion I nor II follow (d) Both conclusion I and II follows
6. **Statement:** Our parliamentary system is not very successful because most of our countrymen cast their votes based on caste and religion.
   Conclusion I: Only educated and principled persons should be given right to vote.
   Conclusion II: We need to create awareness in our people to rise above caste and religion at the time of casting their vote.
   (a) Only conclusion I follow (b) Only conclusion II follow

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(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

7. **Statement:** Some people in this country want the President to be more than a figurehead and to take more active interest in national politics.
Conclusion I: In a parliament democracy, the President has to be content with a more or less passive role.
Conclusion II: The President, under the provision of the Constitution, is bound by the advice of the Council of Ministers and so, he or she should not come into conflict with the Ministry or Parliament.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

8. **Statement:** The TV programmes, telecast specially for women are packed with a variety of recipes and household hints. A major portion of magazines for women also contains the items mentioned above.
Conclusion I: Women are not interested in other things.
Conclusion II: An average women's primary interest lies in home and specially in the kitchen.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

9. **Statement:** Nation N faced growing international opposition for its decision to explode right nuclear weapons at its test site.
Conclusion I: The citizens of the nation favoured the decision.
Conclusion II: Some powerful countries do not want other nation to become as powerful as they are.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

10. Statement: Modern man influences his destiny by the choice he makes unlike in the past.
Conclusion I: Earlier, there were fewer options available to man.
Conclusion II: There was no desire in the past to influence the destiny.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

11. **Statement:** The doctor is of the opinions that the patient's condition would become normal after this operation.
Conclusion I: The patient's condition is such that he can be operated upon.
Conclusion II: Certain costly medicines can be administered to the patient and the operation may not be necessary.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

12. **Statement:** Unemployment allowance should be given to all unemployed Indian youth, above 18 years of age.
Conclusion I: There are a large number of unemployed young people in India who need monetary assistance.
Conclusion II: The government of India has sufficient funds to provide unemployment allowance to all the unemployed young people.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

13. **Statement:** Krishna wrote another letter to his mother after one month as he didn't receive any reply to his first letter.
Conclusion I: Krishna's mother didn't receive the first letter.
Conclusion II: The letter normally reaches within a week.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

14. **Statement:** Sushil has got the railway reservation done in January this year for the journey he wants to make in April to Delhi.
Conclusion I: The railway issue reservation three month in advance.
Conclusion II: There is more than one train to Delhi every day.
(a) Only conclusion I follow (b) Only conclusion II follow

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(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

15. **Statement:** Black cloud follows thunder; rains follow thunder.
Conclusion I: Black cloud is the cause of thunder.
Conclusion II: Thunder is the cause of rain.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

16. **Statement:** The secret of success is constancy of purpose.
Conclusion I: Constant dripping wears the stone.
Conclusion II: Single minded devotion is necessary for achieving success.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

17. **Statement:** The use of non-conventional sources of energy will eliminate the energy crisis in the world.
Conclusion I: The excessive exploitation of environment has led to depletion of conventional sources of energy.
Conclusion II: Modern technology is gradually replacing the conventional source of energy.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

18. **Statement:** Workers feel highly motivated to when they get a sense of involvement by participating in the management of companies.
Conclusion I: Workers should be motivated to produce more.
Conclusion II: Workers should be allowed to participate in the management of companies.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

19. **Statement:** Power consumption in every family has been doubled during the last five years.
Conclusion I: There is a lot of development in the society
Conclusion II: Power rates have become cheaper
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

20. **Statement:** This world is neither good nor evil; each man manufactures a world for himself.
Conclusion I: Some people find this world quite good.
Conclusion II: Some people find this world quite bad.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

21. **Statement:** Industrial cities are highly polluted. Pollution means more diseases.
Conclusion I: People living in cities which are not industrial are healthier than those who live in industrial cities.
Conclusion II: People who live in industrial cities become immune to diseases.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

22. **Statement:** India's economy depends mainly on forests.
Conclusion I: Tree should be preserved to improve Indian economy.
Conclusion II: India wants only maintenance of forests to improve economic conditions
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

23. **Statement:** The best way to escape from a problem is to solve it.
Conclusion I: Your life will be dull if you don't face problem.
Conclusion II: To escape from problem, you should always have some solutions with you.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

24. **Statement:** Sealed tenders are invited from competent contractors experienced in executing construction jobs.
Conclusion I: Tenders are invited only from the experienced contractors.
Conclusion II: It is difficult to find competent tenders in construction jobs.
(a) Only conclusion I follow (b) Only conclusion II follow

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(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

25. Statement: According to a recent report a glass of wine daily for women with breast cancer could boost the success rate of treatment.
Conclusions I: Women taking a glass of wine daily will never suffer from breast cancer.
Conclusion II: A glass of wine will cure the women suffering from breast cancer.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

26. Statement: National integration is necessary because there are diversities in India.
Conclusions I: India is a country of people with diverse cultures, different languages and different social and economic set-ups.
Conclusion II: Ours is a disintegrated nation.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

27. Statement: A Brahmin priest is expected to be able to recite at least one of the Vedas.
Conclusions I: Any person who can recite the Vedas is a Brahmin.
Conclusion II: Reciting the Vedas is a Brahmin's obligation.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

28. Statement: According to a prediction our planet would not be able to support the human population for long, as population grows at geometric rate while food supply grows at arithmetic rate.
Conclusions I: Unchecked growth in population is going to put strain on our food supply.
Conclusion II: Earth is facing the threats of famine in future due to growing population.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

29. Statement: A real friend is one who walks in when the rest of the world walks out.
Conclusions I: A true friend stays with us through rough weather while the fair weather friends leave us in the lurch.
Conclusion II: Adversity is the test of true friendship.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

30. Statement: The distance of 900 km by road between Bombay and Jafra will be reduced to 280 km by sea. This will lead to a saving of ₹ 7.92 crore per annum on fuel.
Conclusion I: Transportation by sea is cheaper than that by road.
Conclusion II: Fuel must be saved to the greatest extent.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

31. Statement: The manager humiliated Sachin in the presence of his colleagues.
Conclusion I: The manager did not like Sachin.
Conclusion II: Sachin was not popular with his colleagues.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

32. Statement: Any young man who makes dowry as a condition for marriage discredits himself and dishonours womanhood.
Conclusion I: Those who take dowry in marriages should be condemned by the society.
Conclusion II: Those who do not take dowry in marriages respect womanhood.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

33. Statement: Just about everyone in Germany has been on a diet at one time or the other and millions of them have learned that the weight they lose is all too easily regained. Still despite their frustration, few question the wisdom of dieting.
Conclusion I: Germans should stop dieting.
Conclusion II: Germans do not learn from experience.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

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34. Statement: The average number of students per teacher is 50 in the urban area whereas it is 60 in rural areas. The national average is 55.
Conclusion I: The student teacher ratio in the rural areas is higher than in the urban areas.
Conclusion II: More students study with the same teacher in rural areas as compared to those in urban area.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

35. Statement: Today out of the world population of several thousand million, the majority of men have to live under government which refuse them personal liberty and the right to dissent.
Conclusion I: People are indifferent to personal liberty and the right to dissent.
Conclusion II: People desire personal liberty and the right to dissent.
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Neither conclusion I nor II follow (d) Both conclusion I and II follows

4.10 Assertion and Reason

'Assertion' refers to stating or claiming something forcefully and that of Reason is fact. The questions based on Assertion and Reason is meant to judge the candidate's knowledge and with it the aim is to determine his ability to reason out correctly. Let us consider an example:

Example: **Assertion (A):** Most of ancient civilisations grew near the rivers.
Reason (R): The main occupation of man was agriculture.
(a) if both A and R are true and R is the correct explanation of A
(b) if both A and R are true but R is not the correct explanation of A
(c) if A is true but R is false
(d) if A is false but R is true
Solution: The Assertion is correct because most of the ancient civilisations grew near the rivers as land over there was fertile and water was easily available. But the Reason is not the correct explanation of the Assertion.

Exercise 4.10

Each of the following questions has an Assertion (A) and a Reason (R). Choose the correct option from the given options, which best supports for the given A and R.

1. Assertion (A): Moon cannot be used as a satellite for communication.
Reason (R): Moon does not move in the equatorial plane of the earth.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

2. Assertion (A): Downpour of rain lessens the humidity in the atmosphere.
Reason (R): Rains are caused when atmosphere cannot hold more moisture.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

3. Assertion (A): Gandhiji withdrew the non-cooperation movement.
Reason (R): There was violence at the Chaurichaura outrage.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

4. Assertion (A): Glass tumbler breaks in winter when hot water is poured in it.
Reason (R): When hot water is poured, the outer surface of glass expands.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

5. Assertion (A): In India, females have higher life expectancy than the males.
Reason (R): Females receive a better diet.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are false (d) A is false but R is true

6. Assertion (A): The India Constitution came into force with effect from 26th January, 1950.
Reason (R): 26th January as celebrated as the Republic Day.

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(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

7. **Assertion (A):** Legumes revive the soil fertility.
Reason (R): microbes in the root nodules of legumes fix the atmospheric nitrogen.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are false (d) A is false but R is true

8. **Assertion (A):** The steam engine was invented by James Watt.
Reason (R): There was a problem of taking out water from flooded mines.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are false (d) A is false but R is true

9. **Assertion (A):** In India, the judiciary is independent of the executive.
Reason (R): Judiciary favours the government and helps in the implementation of its plans.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are false (d) A is false but R is true

10. **Assertion (A):** When a body is dipped in a liquid fully or partially, there is a decrease in its weight.
Reason (R): The decrease in weight is due to the higher density of the displaced liquid.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

11. **Assertion (A):** Plaster of Paris is used by doctors for setting fractured bones.
Reason (R): When Plaster of Paris is mixed with water and applied around the fractured limbs, it sets into a hard mass.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

12. **Assertion (A):** Safety fuses are made up of materials having a high melting point.
Reason (R): Safety fuses should be resistant to electric current.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are false (d) A is false but R is true

13. **Assertion (A):** Most of the ancient civilizations grew near the rivers.
Reason (R): The main occupation of man was agriculture.
(a) Both A and R are false (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

14. **Assertion (A):** Food materials should not be soaked in water for a long time.
Reason (R): Washing leads to loss of vitamin A and Vitamin D from the foodstuff.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

15. **Assertion (A):** Seeds should be treated with fungicide before sown.
Reason (R): Seeds do not germinate, unless treated with fungicide solution.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

16. **Assertion (A):** Mercury is the farthest planet from the sun.
Reason (R): Mercury is the smallest planet in the entire solar system.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

17. **Assertion (A):** Winds are deflected to their right in Northern Hemisphere and to the left in the Southern Hemisphere.
Reason (R): Rotation of earth causes the changes in wind direction.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

18. **Assertion (A):** Sprouting should not be done before consuming the grains.
Reason (R): Sprouting kills many vital vitamins.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) Both A and R are false

19. **Assertion (A):** Africa has one of the largest water power potential in the world.
Reason (R): A large number of hydel power projects have been constructed in Africa.

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(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) Both A and R are false

20. Assertion (A): For the production of aluminum, cheap electricity is essential.
Reason (R): Extraction of aluminum from its ore requires abundant supply of electricity.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) Both A and R are false

21. Assertion (A): On the equinoxes, the day and night are equal all over the globe.
Reason (R): On equinoxes, the position of earth with respect to the sun is such that neither pole is inclined towards the sun.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) Both A and R are false

22. Assertion (A): A person with blood type O is considered a universal recipient.
Reason (R): Type O blood does not contain any antigens.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

23. Assertion (A): To avoid inconvenience to the public, the government must build more of tunnels and underground rails rather than overhead flyovers.
Reason (R): Underground rails can divert lot of traffic and ease out congestion as compared to overhead flyovers.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

24. Assertion (A): The freezing of sea water at minus zero level temperature does not kill the fish.
Reason (R): It is only the top layer of the seawater that gets frozen. The lower level water remains unfrozen and fish can remain alive in it.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

25. Assertion (A): Students should have a clear-cut objective of their future.
Reason (R): Student should be focussed and committed to achieve their goal in life.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

26. Assertion (A): One who does not plans one's future, plans for failure.
Reason (R): Failure is the pillar of success.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

27. Assertion (A): Students should have a definite time-table for preparing for an exam.
Reason (R): To do well in an exam, one must prepare in a planned manner.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

28. Assertion (A): As we go higher up in the mountains, the atmospheric pressure increases.
Reason (R): The air at higher altitudes is comparatively pure.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

29. Assertion (A): Mercury is used in thermometers.
Reason (R): Mercury is the only metal in liquid form.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

30. Assertion (A): Wood does not expand on heating.
Reason (R): Wood does not also float on water.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

31. Assertion (A): A married man is a happy person.
Reason (R): Marriage is a social obligation.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

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32. Assertion (A): Harmonious industrial relations are necessary for faster economic development of a country.
Reason (R): Good relations keep the wheels of a country.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

33. Assertion (A): Stress is a common occurrence in modern life.
Reason (R): Stress is due to absence of meditation and religious belief.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

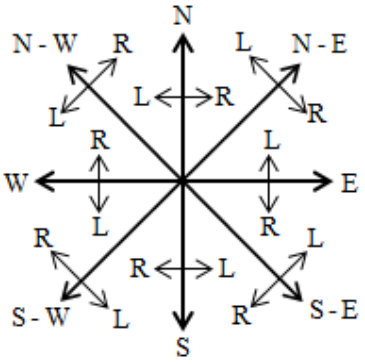
34. Assertion (A): Managers should manage their work-force effectively.
Reason (R): Mismanaged work-force is unproductive.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

35. Assertion (A): Forest cutting is undesirable from the point of view of soil erosion.
Reason (R): Cutting of forest reduces the percolation of rain water.
(a) Both A and R are true and R is the correct explanation of A (b) A is true but R is false
(c) Both A and R are true and R is not the correct explanation of A (d) A is false but R is true

4.11 Direction Sense

In directional problems, the question consists of a sort of directional puzzle. A successive follow-up of direction is formulated and the student is required to ascertain the final direction or distance between two points. The following point must be remembered before tackling any question:

- There are four main directions: **North (N), East (E), West (W), and South (S)**, as shown in figure. These directions came from the word 'NEWS'.
- There are four cardinal directions: **North–East (N–E), North–West (N–W), South–East (S–E), South–West (S–W)** as shown in figure.
- There are four regions: **North–East (N–E), North–West (N–W), South–East (S–E), South–West (S–W)**. It is to be noted that a region is an area and a direction is along the line.
- At the time of sunrise the shadow of an object is always in the west. At the time of sunset the shadow of an object is always in the east.
- Turning from N to E is 90^o clockwise or 270^o anticlockwise. Turning from N to S is 180^o clockwise or anticlockwise. Turning from N-E to S-E is 90^o clockwise or 270^o anticlockwise. Turning from N to N-E is 45^o clockwise or 315^o anticlockwise.
- If you move with you face Eastwards, your left hand in towards North and your right hand in towards South. Similarly the positions of the directions of the hands can be fixed when you move in any of the other directions.
- If a man stands facing the North, at the time of sunrise his shadow will be towards his left and at the time of sunset it will be towards his right.
- At 12:00 noon, the rays of the sun are vertically downward hence there will be no shadow.
- In questions, we will see persons or things moving in N, E, W, S directions from an initial point; then we have to plot the diagram for their movements and then solve the question by carefully observing the diagrammatic presentation.

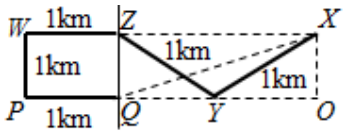


Example [GA-2014 (2 marks)]: X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of W. Q is 1 km east of P. What is the distance between X and Q in km?

(a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) 2

Solution (c): As shown in figure below, the required distance is

$$QX = \sqrt{OQ^2 + OX^2} = \sqrt{ZX^2 + OX^2} = \sqrt{ZY^2 + YX^2 + OX^2}$$

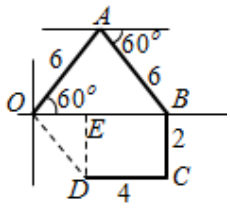


($\because$ OQ = ZX) and ($\because \angle Y = 90^o$). So $QX = \sqrt{1^2+1^2+1^2} = \sqrt{3}$

Example [GA-2015 (1 mark)]: Mr. Vivek walks 6 metres North-east, then turns and walk 6 metres South-east, both at 60 degrees to east. He further moves 2 metres South and 4 metres West. What is the straight distance in metres between the point he started from and the point he finally reached?

(a) $2\sqrt{2}$ (b) 2 (c) $\sqrt{2}$ (d) $1/\sqrt{2}$

Solution (a): As OAB is an equilateral triangle so $OB = 6$. Also OB and DC are parallel to each other so $OE = OB - CD = 6 - 4 = 2$ m. As $ED = BC = 2$ m, so the required distance is $OD^2 = OE^2 + ED^2 = \sqrt{2^2+2^2} = 2\sqrt{2}$ m.

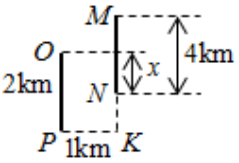


Example [GA-2015 (2 marks)]: Four branches of a company are located at M, N, O and P, M is north of N at a distance of 4 km; P is south of O at a distance of 2 km; N is southeast of O by 1 km. What is the distance between M and P in km?

(a) 5.34 (b) 6.74 (c) 28.5 (d) 45.49

Solution (a): As shown in figure, let $LN = x$ km, since N is southeast of O and M is north of N, so $\angle ONL = 45^o$, $\angle OLN = 90^o$, and so $OL = LN = x$; thus $ON^2 = \sqrt{OL^2 + LN^2} = \sqrt{x^2+x^2} \Rightarrow 1^2 = \sqrt{2x^2} \Rightarrow x = 1/\sqrt{2}$ km. Thus the required distance is $PM = \sqrt{PK^2 + MK^2} \Rightarrow PM = \sqrt{PK^2 + (MN+NK)^2}$

$\Rightarrow PM = \sqrt{x^2 + (4+2-x)^2} = \sqrt{x^2+(6-x)^2} = 5.339 \approx 5.34$ km.



Example [GA-2016 (2 marks)]: **M** and **N** start from the same location. **M** travels 10 km East and then 10 km North-East. **N** travels 5 km South and then 4 km South-East. What is the shortest distance (in km) between **M** and **N** at the end of their travel?

(a) 18.60 (b) 22.50 (c) 20.61 (d) 25.00

Solution (b): The figure is shown as per data given, where $\theta = 45^o$. From ΔADN, $\cos 45^o = \frac{AD}{4} \Rightarrow AD = 2\sqrt{2} = 2.828$

$\sin 45^o = DN/4 \Rightarrow DN = 2\sqrt{2} = 2.828$.

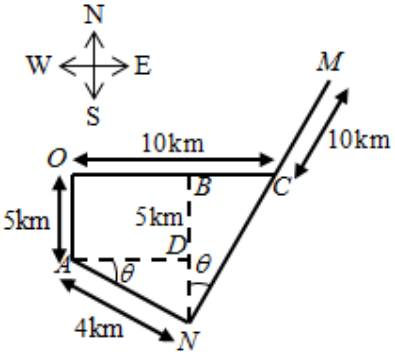
So, $BC = OC - OB = OC - AD$, as $OB = AD$

Thus $BC = 10 - 2.828 = 7.171$ km

Also, $BN = BD + DN = 5 + 2.828 = 7.828$

So from ΔBNC,

$CN = \sqrt{BN^2 + BC^2} = \sqrt{7.828^2 + 7.171^2} = 10.616$ km



Now shortest distance between **M** and **N** at the end of their travel is $MN = CN + CM = 10.616 + 10 = 20.616$ km. So option (c) is correct.

Exercise: 4.11

For Questions 1 to 25: choose the correct option for the question asked. For Questions 26 to 35: fill the calculated value in appropriate place.

1. If Seema and Garima were standing, with their back towards each other, in the morning after sunrise. If Garima's shadow fell exactly towards right hand side, then in which direction Seema was facing?

(a) North (b) East (c) West (d) South

2. A girls was going towards East, then she turned left and then turned 90^o in clockwise direction and finally she turned 45^o in anticlockwise direction. In which direction was she going now?

(a) N-W (b) N-E (c) S-E (d) S-W

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3. Suresh walks 2 km Southward and takes a left turn, walks 5 km and then turns right, walks 3 km and again turning right, walks 8 km. In which direction is he from the starting point?
(a) N-W (b) N-E (c) S-E (d) S-W

4. Ramesh starts from his house and walks Eastward. He then takes a left turn and then a right, before each turn he walks 3 km; finally he turned 180^o in clockwise direction and walks 4 km. In which direction is he walking now?
(a) North (b) East (c) West (d) South

5. During morning if Ram and Shyam were talking to each other sitting opposite to each other. It was observed that Ram's shadow fell to his right. After they finished with talking, Shyam start walking to his right. In which direction does Shyam was walking?
(a) North (b) East (c) West (d) South

6. Mohini starts from her house towards West. After walking a distance of 25m, she turned towards right and walked 10m. She then turned left and after moving a distance 20m, turned to her left again and walked 20m. She then turns to the left and walks 7.5m. Finally, she turned 90^o in anticlockwise direction after she turns to her right. In which direction is she facing now?
(a) North (b) East (c) West (d) South

7. Soniya went 50m toward the North, then turned right and went 50m. She again turned left and went 50m. She took a 135^o turn towards her left and went 25m. Finally she took a 135^o turn in clockwise direction and went straight. In which direction is she walking now?
(a) West (b) North-East (c) North-West (d) North

8. Rakhi goes 4 km West, then turns left and goes 3 km. Then, she turns right and goes 4 km and then she turns right and goes 3 km; then she turned 495^o towards her right and goes 5 km and finally she turned 90^o in clockwise direction and goes 5 km. At what distance is she from the starting point now?
(a) 5 km (b) 10 km (c) 15 km (d) None of these

9. Six flats on a floor in two rows facing East and West are allotted to A, B, C, D, E, F. B gets the East facing flat and is not to next to D. D and F get diagonally opposite flats. C next to F gets the West facing flat and E gets the East facing flat. Which of the following combination gets an East facing flat?
(a) BED (b) FCA (c) BAC (d) Cannot be determined

10. I am standing at the centre of the circular field. I go down south to the edge of the field and then turns left I walk along the boundary of the field equal to the $3/8^{th}$ of its length. Then I turn west and go right across to the opposite point on the boundary. In which direction I am from the starting point?
(a) North-West (b) North (c) South-West (d) West

11. Shilpa decided to walks from her home 1km East then $1/2$ km to North. Then $1/4$ km to West, then $1/8$ km to South and so on making a loop. Finally how far she is from her home and in which direction?
(a) 0.7944, N-E (b) 0.8944, N-W (c) 0.8944, N-E (d) 0.7944, N-W

12. Reema travels 10km towards East. From there, she travels 4km towards West. Then she travels 6km towards South. How far is she from the starting point? What is her final direction from the starting point? In which direction she is facing?
(a) $6\sqrt{2}$, S, S-E (b) $6\sqrt{3}$, S-E, S (c) $6\sqrt{2}$, S-E, S (d) $6\sqrt{3}$, S, S-E

13. After taking his lunch at 3:00 PM, Ramesh goes facing the sun. Then he turns to his left, then turn to his right and then turn to his right and then to his left. Finally he turned 180^o towards his left. In which direction is he moving?
(a) North (b) East (c) West (d) South

14. I walk out of my back door of my house, whose front door is in the East direction. After walking 4km, I turned right and walk another 4km, then turn left and walk 4km and turn right again and walk 4km. In which direction am I facing w.r.t starting point?
(a) South-West (b) North-East (c) South-East (d) North-West

15. A girl is facing towards North. She turns 60^o to her right and then turns 105^o in the anticlockwise direction. In which direction now she is facing?
(a) South-East (b) North-East (c) South-East (d) North-West

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16. One day, Ravi left home and cycled 2km southwards, turned right and cycled 3km and turned left and cycled 4km. Further he turned 45^o to his right and cycled $\sqrt{2}$ km, then he tuned 90^o in anticlockwise direction and cycled $2\sqrt{2}$ km. Finally he 45^o in anticlockwise direction and cycled 2km. How many kilometres and in which direction will he have to cycle to reach his home straight?
(a) 9km, South **(b) 9km, North** **(c) 8km, South** **(d) 8km, North**

17. Mahesh walk 4 km towards North. Then he turns right and walks 6 km. Then he turns right and walks 7 km. Then he turns left and walks 3 km. Then he gains turns left and walks 3 km. In which directions and how many metres away is he from his original positions?
(a) 9 km, East **(b) 6 km, East** **(c) 6 km, West** **(d) 9 km, West**

18. From his house, Lokesh went 5 km to the South. Then he turned 135^o toward his left and went $2\sqrt{2}$ km. He then turned 90^o in clockwise direction and went $3\sqrt{2}$ km. Finally he turned 225^o in clockwise direction and continue his journey for 11 km. In which directions and how many kilometres away is he from his original positions?
(a) $5\sqrt{2}$, S-W **(b) $2\sqrt{5}$, S-W** **(c) $5\sqrt{2}$, N-E** **(d) $2\sqrt{5}$, S-W**

19. If Amit is to the South of Bhawna and Chinmay is to the East of Bhawna; then in what direction is Chinmay w.r.t. Amit?
(a) North-East **(b) North-West** **(c) South-East** **(d) South-West**

20. Ravi wants to go to the school. He starts from his home which is in the North and comes to the crossing. The road to the left ends in a theatre, straight ahead is the hospital. In which direction is the school?
(a) North **(b) East** **(c) West** **(d) South**

21. P, Q, R and S are playing carom game. P, S and R, Q are partners. If R is sitting to the left of S who is facing toward N-E, then in which direction Q is facing?
(a) N-W **(b) S-E** **(c) S-W** **(d) Cannot be determined**

22. A 12 hour clock reads 7:30. If the minute hand points towards East, in what direction does the hour hand point?
(a) North **(b) North-West** **(c) South-East** **(d) North-East**

23. A 12 hour clock reads 1:30. If the hour hand points towards North-West, in what direction does the minute hand point?
(a) North **(b) East** **(c) West** **(d) South**

24. Facing the east, Ramesh turned left and walked 10m, then he turned to his left again and walked 10m. He then turned θ (in degrees) and went straight to cover 25 metres. Finally he is in North-West direction from his starting point. What is θ?
(a) 90^o towards his right **(b) 45^o towards his left**
(c) 90^o towards his right **(d) 45^o towards his right**

25. A man walks 10 km towards north. From there he walks 6 km towards south. Then he walks x km towards some direction d. Finally he is 5km in North-East direction from the starting point. What is x and d.
(a) 3, West **(b) 4, East** **(c) 4, West** **(d) 3, East**

26. Reema walks 7m in West and then 2m to the left. Now every time turning to her right, she walks 3, 6, and 10m respectively. How far (in metres) is she now from her starting point? _____

27. Deepak starts walking straight towards east. After walking 1 metres, he turns to the left and walk 2 metres straight. He turns 45^o to his right and walks a distance of $2\sqrt{2}$ metres. How far (in metres) is he from the starting point? _____

28. A boy facing south turns 88^0 to his right. About how much angle (in degrees) he should turn in anticlockwise direction so that his final position will be in North-West direction. _____

29. A man heading towards East and on the way he turns left and goes in the semi-circle round a hillock. About how much angle (in degrees) to his left he should turn so that he will face along North-East direction. _____

30. A man runs 17m towards East and turns to right, runs 16m and turns to right, runs 9m and again turns to left, runs 5m and turns to left , runs 12m and finally turns to left and runs 6m . At this point what is the minimum distance between his initial and final position? _____

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31. Amit and Bhawna start moving towards each other, at the same time, from two places which is 1km apart. After walking 100m, Bhawna turns left and goes 50m, and then she turns right and goes 150m. She then turns right again, and comes back to the road on which she had started walking. If speed of Amit is twice of that of Bhawna, then what is the distance between them, if Amit walks without any break and turns? _____

32. After going 2 m towards South, Harish takes a right turn and goes another 6 m. He then takes a left turn and goes 6 m. How far (in metres) is he from the starting point? _____

33. A girl moves out from her house and runs 1km towards East, she then took a left turn and reaches the circular field, whose circumference is $\pi/2$ km, after running 2km. She turns 90^0 to her right and runs $5/4^{th}$ round around the circumference. What is the shortest distance (in km) between her final position and her home? _____

34. On a playing ground Deepak, Kavita, Naveen, Aman and Poonam are standing facing towards North direction. Kavita is 4m to the right of Aman. Deepak is 6m to the south of Kavita. Naveen is 2m to the west of Aman. Poonam is 2m to the south of Deepak. If a boy wants to meets frstly Naveen and then Poonam, then how many minimum metres have to walk? _____

35. Amit is 6m southwards of Garima. Bhanu is 8m westward of Garima. Chintu is eactly in the middle of Amit and Bhanu. What is the distance between Bhanu and Garima? _____

4.12 Comparison Based Problems

In such type of questions, clues are given regarding comparisons among a set of persons or things with respect to one or more qualities. The candidate is required to analyse the whole information, form a proper ascending or descending sequence and then answer the given questions accordingly. Let us consider some examples:

Example [GA-2010 (2 marks)]: Hari (H), Gita (G), Irfan (I) and Saira (S) are siblings (i.e. brothers and sisters). All were born on 1st January, The age difference between any two successive siblings (that is born one after another) is less than 3 years. Given the following facts: (i) Hari's age + Gita's age > Irfan's age + Saira's age. (ii) The age difference between Gita and Saira is 1 year. However, Gita is not the oldest and Saira is not the youngest. (iii) There are no twins. In what order were they born (oldest first)?

(a) HSIG (b) SGHI (c) IGSH (d) IHSG

Solution (b): (i) $\Rightarrow H+G>I+S$; (ii) $\Rightarrow |G-S|=1 \Rightarrow G$ and S are next to each other in the order as there are no twins so in one year only one person can be born; thus option (a) is not correct as in this option we do not have G and S next to each other. Now going by the options we will try to solve the question. For option (b) we have $S>G>H>I \Rightarrow S>G$ …(iii) and $S>H$ (iv); now adding (iii) and (i) we get $H>I$ which is true for option (b); also adding (iv) and (i) we get $G>1$ which is true for option (b), and thus it is correct. For option (c) we have $I>G>S>H \Rightarrow I>G$ and on adding it with (i) we get $H>S$ which is not true for option (c), and thus it is not correct. For option (d) we have $I>H>S>G \Rightarrow S>G$ and on adding it with (i) we get $H>I$ which is not true for option (d), and thus it is not correct.

Example [GA-2012 (2 marks)]: Ravi is taller than Arun but shorter than Iqbal. Sam is shorter than Ravi. Mohan is shorter than Arun. Balu is taller than Mohan and Sam. The tallest person can be

(a) Mohan (b) Ravi (c) Balu (d) Arun

Solution (c): Let Ravi $=R$; Arun $=A$; Iqbal $=I$; Sam $=S$; Mohan $=M$; Balu $=B$. In terms of height, we have $A<R$ …(i); $R<I$ …(ii); $S<R$ …(iii); $M<A$ …(iv); $M<B$ …(v); $S<B$ …(vi). (iv) and (v) $\Rightarrow M<A<B$ …(vii); (vi) and (iii) $\Rightarrow S<R<B$ …(viii); (viii) and (ii) $\Rightarrow S<R<I<B$ …(ix). Now from (vii) and (ix) we can say that B is tallest person.

Example [GA-2013 (2 marks)]: *Abhishek is elder to Savar. Savar is younger to Anshul.*
Which of the given conclusions is logically valid and is inferred from the above statements?

(a) Abhishek is elder to Anshul (b) Anshul is elder to Abhishek

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(c) Abhishek and Anshul are of the same age (d) No conclusion follows

Solution (d): Let Ab, S, An be Abhishek, Savar and Ansul, respectively. Then in terms of age, we have: $S < Ab$ …(i); $S < An$ …(ii). Thus from (i) and (ii), we cannot conclude between An and Ab.

Example [GA-2014 (2 marks)]: In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?

Statements: 1. Shiv is younger to Riaz. 2. Shiv is elder to Som.

(a) Statement 1 by itself determines the eldest child.
(b) Statement 2 by itself determines the eldest child.
(c) Statements 1 and 2 are both required to determine the eldest child.
(d) Statements 1 and 2 are not sufficient to determine the eldest child.

Solution (a): From the given data we have: $Som < Riaz$ …(i); $Ansu < Shiv$ …(ii); $Ansu$ is youngest in the group …(iii). From statement 1 we have $Shiv < Riaz$ …(iv). Thus from (ii), (iii) and (iv) we have $Ansu < Shiv < Riaz$ …(v); now from (i) and (v) we have $Riaz$ is the eldest child. So statement 1 by itself determines the eldest child.

Example [GA-2015 (1 mark)]: 1. Tanya is older than Eric. 2. Cliff is older than Tanya. 3. Eric is older than Cliff. If the first two statements are true, then the third statement is:

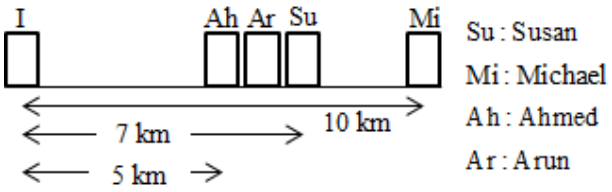
(a) True (b) False (c) Uncertain (d) Data insufficient

Solution (b): Let T, E and C be Tanya, Eric and Cliff, respectively. So in terms of age we have: $T > E$ …(i); $C > T$ …(ii). Combining (i) and (ii), we get $C > T > E \Rightarrow C > E$, i.e. Cliff is old than Eric, which contradicts the third statement and thus it is false.

Example [GA-2016 (1 mark)]: Michael lives 10 km away from where I live. Ahmed lives 5 km away and Susan lives 7 km away from where I live. Arun is farther away than Ahmed but closer than Susan from where I live. From the information provided here, what is one possible distance (in km) at which I live from Arun's place?

(a) 3.00 (b) 4.99 (c) 6.02 (d) 7.01

Solution (c): From the given data, we can make the following diagram. Based on the diagram we can say that 'the distance at which I live from Arun's place must be greater than 5 km and less than 7 km'. So from the given options, option (c) satisfies the criteria and hence option (c) is correct.



Example [GA-2016 (2 marks)]: Leela is older than her cousin Pavithra. Pavithra's brother Shiva is older than Leela. When Pavithra and Shiva are visiting Leela, all three like to play chess. Pavithra wins more often than Leela does.

Which one of the following statements must be TRUE based on the above?

(a) When Shiva plays chess with Leela and Pavithra, he often loses.
(b) Leela is the oldest of the three.
(c) Shiva is a better chess player than Pavithra.
(d) Pavithra is the youngest of the three.

Solution (d): From the first sentence of the given data, **'Leela is older than her cousin Pavithra. Pavithra's brother Shiva is older than Leela'**, the following arrangement (decreasing order of age) is possible: Shiva > Leela > Pavithra . Hence we can say that option (d) is correct and option (b) is not correct. Also the last sentence, **'Pavithra wins more often than Leela does'**, is not telling anything about Shiva, so options (a) and (c) may or may not be correct.

Exercise 4.12

Choose the most appropriate option by using the information or data given in each question.

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1. In a group of six students A, B, C, X, Y, Z, X is taller than A. Y and B are of same height. Z is shorter than C. A is taller than Y. Who is the tallest person in the group?
(a) X (b) Y (c) A (d) C

2. In a group of five boys, Vinay is elder than Sanjay. Vimal is younger than Dinesh. Kamal's age is between Vinay and Vimal. Who is youngest in the group?
(a) Vimal (b) Dinesh (c) Sanjay (d) Kamal

3. In an examination, Rajul got more marks than Suresh but not as many as Kiran. Kiran get more marks than Gaurav and Manisha. Gaurav got less marks than Suresh but his marks are not the lowest in the group. Who is the second in the descending order of marks?
(a) Kiran (b) Manisha (c) Rajul (d) Suresh

4. Consider the following statements: Pooja is faster than Tashi and slower than Sara; Neha is slower than Tashi; Jeet is not faster than Manoj; Manoj is slower than Neha. Who is the fastest?
(a) Sara (b) Pooja (c) Tashi (d) Manoj

5. If Raj's salary is more than Umesh's; Neelams salary is more than Pooja's; there is no salary difference between Umesh and Neelam; then Neelam's salary is
(a) more than Raj's salary (b) less than Raj's salary
(c) equal to Raj's salary (d) less than Pooja's salary

6. Consider the following statements: E is taller than F and shorter then D; D is shorter than B and C; A is taller than B. Which of the following must be true?
(a) A is the tallest (b) C is the tallest
(c) Neither A nor C are the tallest (d) F is the shortest

7. Consider the following statements: R and S are heavier than T; V is heavier than W and X; U is lighter than X; T is heavier than V. Which of the following must be true?
(a) R is heaviest (b) T is lightest (c) S is heavier than X (d) X is heavier than T

8. In a match, Yuvraj scored more runs than Raina. Sachin scored more runs than Laxman but less than Virat. Mohit scored as much runs as Dhoni but less than Virat and more than Sachin. Raina scored more runs than Virat. Each batsman scored 10 runs more than his immediate batsman. The lowest score was 10 runs. How many runs did Yuvraj scored?
(a) 40 (b) 50 (c) 60 (d) 70

9. Consider the following statements: E is heavier than A; A and B are heavier than C; D and H are lighter than C; F and G are lighter than D and H. Which of the following must be true?
(a) B is the heaviest (b) C is heavier than F
(c) G is the lightest (d) D is heavier than H but lighter than A

10. Consider the following statements: P is not the tallest; R is not the smallest; Q is shorter than P; S is taller than R. The next to shortest person is
(a) P (b) Q (c) R (d) Cannot be determined

11. If Lalit's salary is more than Bobby and Chintu together, but Lalit's salary is less than Chintu and Juhi together, which one of the following must be true?
(a) Lalit earns more than Juhi (b) Juhi earns more than Bobby
(c) Chintu earns more than Bobby (d) Juhi earns more than Chintu

12. Consider the following statements: C is elder than D but younger than B; B is elder than A and C but younger than E; A is elder than D but younger than C. Which one is second last from youngest?
(a) A (b) B (c) C (d) D

13. 500 men are arranged in an array of 10 rows and 50 columns according to their heights. A is the shortest among all the tallest persons of each row. B is the tallest among all the shortest person of each column. Find the relation between A and B in terms of their height.
(a) A > B (b) A < B
(c) A = B (d) A ≥ B or A ≤ B

14. Consider the following statements: P runs faster than Q; R runs slower than S; T is the slowest runner; Q and R runs at the same speed; S runs faster than Q. Which of the following must be true?
(a) P and S runs at the same speed (b) P is the fastest runner
(c) S is the fastest runner (d) R runs slower than P

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15. A family has seven children, each born two years apart; and the sum of their ages 91. Their names are Himanshi, Jeevan, Suresh, Kamal, Lokesh, Mahesh, and Neelam. The following conditions must be met: Suresh is older than Mahesh; Himanshi is older than Lokesh but younger than Jeevan; Either Jeevan or Lokesh is 13 years old; Neelam is younger than Suresh. The difference in ages between Mahesh and Neelam is at least three years. Which one of the following must be true?

(a) Himanshi is the oldest (b) Kamal is older than Suresh
(c) Himanshi is younger than Suresh (d) Jeevan is older than Lokesh

16. Based on the data given in Q. 15, which one of the following must be true?

(a) Kamal is two year older than Himanshi (b) Suresh is two years younger than Mahesh
(c) Lokesh is two years younger than Kamal (d) Suresh is two years older than Himanshi

17. Eight children A, B, C, D, E, F, G, and H, are playing in a garden. No two of these children are of same height. The following statements describe the relative height of the children: E is taller than A; B shorter than G but taller than H; D is taller than G; F shorter than A but taller than C; G is taller than F. Which one of the following statements must be true?

(a) D lifts more than F (b) F lifts more than Prcscott
(c) E lifts more than B (d) C lifts more than E

18. From the data given in Q. 17, if H is taller than A, then which one of the following must be true?

(a) G is taller than A (b) A is taller than B
(c) E is taller than B (d) D is taller than E

19. Consider the following statements: A is heavier than B but lighter than C; B is lighter than D but heavier than E; F is lighter than A but heavier than B; G is heavier than D but lighter than F; H is lighter than B. Which one of the following must be true?

(a) E is heavier than H (b) E is the lightest of all
(c) F is heavier than D (d) H is the lightest of all

20. From the data given in Q. 19, if Q is added to the group and is heavier than B but lighter than G, then Q must be

(a) lighter than D (b) between D and F
(c) heavier than only three of the others (d) shorter than at least three of the others

21. Suresh is as much older than Kamal as he is younger than Prabodh. Navin is as old as Kamal. Which of the following statements is wrong?

(a) Suresh is older than Navin (b) Kamal is younger than Suresh
(c) Prabodh is not the oldest (d) Navin is younger than Prabodh

22. Sushma is richer than Rashmi where as Anand is richer than Priya. Arun is as rich as Rashmi. Shoba is richer than Sushma. Which of the following statements is correct?

(a) Rashmi is poorer than Priya (b) Priya is richer than Arun
(c) Arun is poorer than Sushma (d) Anand is richer than Rashmi

23. Mayur, Pranab, Ashok and Kabul are four friends. Consider the following statement: (P) Pranab is heavier than Mayur and Kabul but lighter than Ashok; (Q) Mayur is lighter than Pranab and Ashok but heavier than Kabul. To find out who among them is the heaviest, which of the following information given in the statements P and Q is/are sufficient?

(a) Either P or Q is sufficient (b) Both P and Q together are not sufficient
(c) Only P is sufficient (d) Only Q Is sufficient

24. Raj is taller to Soniya. Soniya is shorter to Aneeta. Which of the given conclusions is logically valid and is inferred from the above statements?

(a) Raj is taller to Aneeta (b) Aneeta is taller to Raj
(c) Raj and Aneeta are of the same height (d) No conclusion follows

25. A, B, C, D, E are five persons. Consider the following statements: (P) D is heavier than only one person, B is lighter than only one person, and C is heavier than at least two persons; (Q) C is heavier than exactly two persons, nobody in a group is heavier than A, and at least one person is heavier than B. To find out who is lighter than C, which of the statements P and Q is/are sufficient.

(a) Either P or Q is sufficient (b) Both P and Q together are sufficient

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(c) Only P is sufficient (d) Only Q Is sufficient

26. A is not lighter than B, who in turn, is not heavier than C who is lighter than D. Consider the following statements: (P) C and A are of equal weights; (Q) B and A are of equal weights. To find out who is the heaviest among A, B, C, D, which of the statements P and Q is/are sufficient?
(a) Either P or Q is sufficient (b) Both P and Q together are not sufficient
(c) Only P is sufficient (d) Only Q is sufficient

27. A is younger than B. C is elder than D. Consider the following statement: (P) A is younger than D; (Q) A is elder than C. To find who is the youngest among A, B, C, D, which of the statements P and Q is/are sufficient?
(a) Either P or Q is sufficient (b) Both P and Q together are not sufficient
(c) Only P is sufficient (d) Only Q is sufficient

28. Consider the following statements: (P) T is taller than R, M and Q and shorter than K; (Q) R, T and M are shorter than K but taller than Q. To find who is tallest among M, T, R, K and Q, which of the statements P and Q is/are sufficient?
(a) Either P or Q is sufficient (b) Both P and Q together are not sufficient
(c) Only P is sufficient (d) Only Q is sufficient

29. A, B, C, D, and E are five friends. B is elder to E, but not as tall as C. C is younger to A, and is taller to D and E. A is taller to D, But younger to E. D is elder to A but is shorter in the group. Who is the eldest?
(a) B (b) C (c) D (d) None of these

30. A, B, C, D, E and F are six students in a class. B and C are shorter than F but heavier than A. D is heavier than B and taller than C. E is shorter than D but taller than F. F is heavier than D. A is shorter than E but taller than F. Who is the shortest among them?
(a) B (b) C (c) D (d) Cannot be determined

31. There are five friends --- Sachin, Kunal, Mohit, Anuj and Rohan. Sachin is shorter than Kunal but taller than Rohan. Mohit is the tallest. Anuj is a little shorter than Kunal and little taller than Sachin. Who is the shortest?
(a) Rohan (b) Sachin (c) Mohit (d) Kunal

32. Nine children Farheen, Geet, Hritik, Irfan, Jacky, Khushi, Leela, Mansi, and Navneet are playing in a playground. Khushi's weight is greater than both Irfan's and Leela's. Leela's weight is greater than Navneet's. Irfan's weight is greater than Farheen's. Farheen's weight is greater than Mansi's. Mansi's weight is greater than Geet's. Geet's weight is greater than Jacky's. Jacky's weight is greater than Hritik's. If Navneet's weight is the same as that of one other partner of the firm, which one of the following must be false?
(a) Irfan's weight is less than Leela's (b) Jacky's weight is less than Leela's
(c) Leela's weight is less than Farheen's (d) Leela's weight is less than Hritik's

33. Ten persons: Ashok, Bipin, Chintu, Divya, Ehtishan, Fhatima, Girish, Himanshu, Imarti, and Jhanvi are comparing their heights. Jhanvi is taller than Divya. Himanshu and Imarti are the same height and both are shorter than Divya. Imarti is taller than Bipin. Both Ashok and Ehtishan are taller than Girish. Both Chintu and Fhatima are shorter than Girish. Based on the given information, which of the following can be incorrect?
(a) Ashok is taller than Fhatima (b) Bipin is shorter than Jhanvi
(c) Jhanvi is shorter than Ehtishan (d) Fhatima is shorter than Ashok

34. From the data given in Q. 33, if Girish is the same height as Imarti, then which one of the following can be false?
(a) Divya is taller than Ehtishan (b) Jhanvi is taller than Bipin
(c) Ehtishan is taller than Chintu (d) Himanshu is taller than Fhatima

35. Amit, Babita, Chandni, Dravid, Emran, Farah, Geet, and Harshit are all students. Farah is the same height as Harshit. Geet is taller than Farah. Emran is taller than Amit. Amit is taller than Dravid and Chandni. Babita is shorter than Chandni. Then which of the following is true?
(a) Chandni is taller than Dravid (b) Chandni is shorter than Dravid
(c) Babita is taller than Emran (d) Babita is shorter than Emran

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4.13 Seating or Placing Arrangement and Ranking

In seating/placing sequence, which may be either linear or circular, some clues regarding of some persons or objects are given. The candidate is required to form the proper sequence using these clues and answer the questions accordingly. It is to be noted that the conventions for left and right in seating or placing arrangement in a line is considered same as in direction sense. On the other hand, for the seating or placing arrangement around a circular path, the left side is chosen in clockwise sense, and the right side is chosen in anticlockwise sense. In ranking problem, some clues regarding of some persons or objects are given. The candidate is required to form the proper sequence using these clues and answer the questions accordingly.

Example [GA-2011 (2 mark)]: L, M and N are waiting in a queue meant for children to enter the zoo. There are 5 children between L and M, and 8 children between M and N. If there are 3 children ahead of N and 21 children behind L, then what is the minimum number of children in the queue?
(a) 28 (b) 27 (c) 41 (d) 40

Solution (a): We do not have any order in which L, M and N are standing. So we have the following possibilities which are shown in the figure. Possibilities I and II are not correct as if 3 children ahead of N then there is no chance of having 21 children behind L. Possibilities IV and V are also not correct as, 8 children between M and N contradicts with 5 children between L and M. Now for possibility III, we have 21 children behind L, which also includes M, i.e. there are $21-5-1(\text{M})=15$ children behind M; 8 children between M and N, which also includes L; thus we have a total of $3+1(\text{N})+8+1(\text{M})+15=28$ children in possibility III. Similarly in possibility VI, we have a total of $3+1(\text{N})+8+1(\text{M})+5+1(\text{L})+21=40$ children. So, minimum number of children is in possibility III which has 28 children.

×	×		×	×	
I	II	III	IV	V	VI
		3			3
L	M	N	L	M	N
					8
M	L	L	N	N	M
		5			5
N	N	M	M	L	L
					21

Example [GA-2014 (2 mark)]: Anuj, Bhola, Chandan, Dilip, Eswar and Faisal live on different floors in a six-storeyed building (the ground floor is numbered 1, the floor above it 2, and so on). Anuj lives on an even-numbered floor. Bhola does not live on an odd numbered floor. Chandan does not live on any of the floors below Faisal's floor. Dilip does not live on floor number 2. Eswar does not live on a floor immediately above or immediately below Bhola. Faisal lives three floors above Dilip. Which of the following floor-person combinations is correct?

	(a)	(b)	(c)	(d)
Anuj	6	2	4	2
Bhola	2	6	2	4
Chandan	5	5	6	6
Dilip	1	1	3	1
Eswar	3	3	1	3
Faisal	4	4	5	5

Solution (b): Options (c) and (d) are not correct as Faisal lives three floors above Dilip. Option (a) is not correct as Eswar does not live on a floor immediately above or immediately below Bhola. Thus we are left with option (b) which satisfies all the criteria.

Exercise: 4.13

Choose the correct option for those questions where options are given. Fill the calculated value in appropriate place, where it is required for the questions.

1. A cricket team of 11 players lined up in a straight line to have their photograph. The captain was asked to stand in the centre of the line-up. Virat and Rehane stood to the right of the captain; Two players stood between Dhawan and Rohit; Seven players stood between Binny and Raina; Jadeja stood to the right of Dhoni; Patel and Ashwin stood either side of Dhawan; Kumar and Ashwin stood to the left of the captain; Six players stood between Rehane and Dhawan; Two players stood between Dhawan and Kumar. Who is the captain and what is the position of Binny, Ashwin and Jadeja if the extreme left is numbered as position 1?
(a) Dhoni; Binny: 2 or 10; Ashwin: 3 or 5; Jadeja: 8 or 9

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(b) Rohit; Binny: 2 or 10; Ashwin: 3 or 5; Jadeja: 8 or 9
(c) Rohit; Binny: 3 or 5; Ashwin: 2 or 10; Jadeja: 8 or 9
(d) Dhoni; Binny: 8 or 9; Ashwin: 3 or 5; Jadeja: 2 or 10

2. Four couples are going to the movie. Each row holds eight seats. Bhavna and Ajay don't want to sit next to Ankita and Anupam. Ankita and Anupam don't want to sit next to Ginny and Bharat. On the other hand, Shilpa and Mahesh don't want to sit next to Bhavna and Ajay. How can the couples arrange themselves in a row so that they all sit where they would like?
(a) (Ginny & Bharat) - (Bhavna & Ajay) - (Shilpa & Mahesh) - (Ankita & Anupam)
(b) (Bhavna & Ajay) - (Ginny & Bharat) - (Shilpa & Mahesh) - (Ankita & Anupam)
(c) (Bhavna & Ajay) - (Ginny & Bharat) - (Ankita & Anupam) - (Shilpa & Mahesh)
(d) (Bhavna & Ajay) - (Shilpa & Mahesh) - (Ginny & Bharat) - (Ankita & Anupam)

3. Four men - Ajeet, Bhavesh, Chinmay and Deepak - are standing in a straight line. One man is fair, handsome and unscarred; Two men who are not fair, are each standing next to Ajeet. Bhavesh is the only man standing next to exactly one handsome man. Chinmay is the only man not standing next to exactly one scarred man. Who is fair, handsome and unscarred?
(a) Ajeet (b) Bhavesh (c) Chinmay (d) Deepak

4. Ankita, her brother - Ankit, her daughter - Aneeta, and her son, Aman are playing a tennis game of doubles. As Ankita's brother is directly across the net from Aneeta; Aman is diagonally across the net from the worst player's sibling; The best player and the worst player are on the same side of the net. Who is the best player?
(a) Ankita (b) Ankit (c) Aneeta (d) Aman

5. Six cabins numbered 1-6 consecutively, are arranged in a row and are separated by thin dividers. These cabins must be assigned to six staff members based on following facts. B's work requires her to speak on the phone frequently throughout the day; F prefers cabin number 5 as 5 is her lucky number; A and C often talk to each other during their work and prefers to have adjacent cabins; D, A and E all smoke. F is allergic to smoke and must have non-smokers adjacent to her. E needs silence during work. Can you tell the cabin numbers of each of them?
(a) A : 2; B: 6; C : 4; D: 3; E: 1; F: 5 (b) A : 3; B: 4; C : 6; D: 2; E: 1; F: 5
(c) A : 3; B: 6; C : 4; D: 2; E: 5; F: 1 (d) A : 3; B: 6; C : 4; D: 2; E: 1; F: 5

6. Six persons, X, Y, Z, A, B and C, are sitting in two rows three in each. B is not at the end of any row. A is second to the left of F. Z, who is the neighbour of B, is sitting diagonally opposite to A. Y is the neighbour of C. Which is the other pair who is sitting diagonally opposite to each other? Who is facing Y?
(a) X & C; B (b) X & Y; C (c) X & B; Z (d) Y & B; X

7. There are five friends. They are standing in a row facing south. A is to the immediate right of B. C is between D and E. E is between A and C. Who is at the extreme left and right positions? Who is in the middle?
(a) B, D; E (b) D, B; E (c) A, C; B (d) C, A; B

8. Seven friends, L, M, N, O, P, Q and R, are sitting on a wall, and all of them are facing towards west. N is on the immediate right of O. M is at an extreme end and P as his neighbour. R is between P and Q. O is sitting third from the north end. How the seven friend are sitting from South to North?
(a) L, N, O, Q, R, P, M (b) M, N, Q, O, R, P, L
(c) M, P, R, Q, O, N, L (d) L, P, R, O, Q, N, M

9. Eleven persons A, B, C, D, E, F, G, H, I, J and K, are facing toward north. D, who is to the immediate left of F, is second to the right of C. A is second to the right of E, who is at one of the ends. J is the immediate neighbour of A and B and third to the left of G. H is to the immediate left of D and third to the right of I. Who is at the extreme left? Who is at the extreme right? Who is in the middle? Who is to the right of B?
(a) F, E, B, I (b) E, F, I, B (c) E, F, I, I (d) F, E, B, B

10. There are seven shirts of different colour, White, Black, Green, Yellow, Purple, Orange, and Red, lying on a table one above the other. Yellow shirt is on the top of all the books. Red shirt is immediately below Orange shirt, which is immediately below Yellow shirt. Purple shirt is immediately above White shirt, but not in the middle. Black shirt is immediately below White

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shirt. Which colour of shirt is placed on top, bottom and middle? Which colour of shirt is placed between yellow and red colour shirt?
(a) Black, Yellow, Green; Orange (b) Yellow, Black, Green; Orange
(c) Yellow, Black, Orange; Green (d) Black, Yellow, Orange; Green

11. In a car exhibition, seven cars of seven different companies namely, A, B, C, D, E, F and G were displayed in a row, facing toward south. A car was to the immediate right of G. G was fourth to the right of C. D car was between B and F. C, which was third to the left of B car, was at one of the ends. What is the sequence of cars from left to right if a person is seeing the rear parts of the cars?
(a) C, F, D, B, G, A, E (b) E, A, G, B, D, F, C
(c) E, F, D, B, G, A, C (d) C, A, G, B, D, F, E

12. Six friends P, Q, R, S, T and U are sitting around a circle facing towards the centre. T is to the left of S. R is between P and Q. U is between T and P. What is the sequence of sitting in clockwise direction starting from T?
(a) S, Q, R, P, U (b) U, P, R, Q, S (c) U, Q, R, P, S (d) S, P, R, Q, U

13. Eight persons, P, Q, R, S, T, U, V and W, are seated around a rectangular table two on each side. There are three females and they are not seated next to each other. U is between S and Q. R is between T and Q. S, who is a female, is to the left of U. Q, who is a male, is seated diagonally opposite P, who is a female. There is a female person sitting between Q and T. _____ is seated between P and S. There are _____ person seated between V and Q. The third female person is _____.
(a) W, 2, R (b) W, 3, R (c) U, 2, V (d) U, 3, V

14. P, Q, R, S, T, U and V are sitting around a circle facing toward the centre. S, who is second to the right hand side of R, is not to the immediate right to V. U is not between V and T. P is between R and Q. If Q and R interchange places so as to be like T and V, then which of the following is true?
(a) S is third to the right of R (b) T is second to the left of R
(c) Q is fourth to the right of T (d) None of these

15. Six friends A, B, C, D, E and F are seated around a circular table facing each other. A is between D and B and F is between C and E. C is the third to the left of B. Which of the following statement is correct?
(a) A is second to the left of F (b) A is second to the right of F
(c) A is fourth to the right of F (d) A is third to the right of F

16. Eight friends P, Q, R, S, T, U, V and W are sitting around a circular table facing toward the centre. Q is sitting between V and S. W is third to the left of Q and second to the right of P. R is sitting between P and V. Q and T are not sitting opposite to each other. Who is sitting third to the left of S?
(a) T (b) P (c) U (d) S

17. Two union representatives and one management representative are seated together at an octagonal table with only one seat to a side of the table. No pair of either union or management representatives may be seated together. Two additional management representatives are to be seated. Seated between the two union representatives are _____. Seated opposite of the first management representative _____.
(a) not more than one management representative; must be a management person
(b) at most 2 management representatives; must be a union person
(c) only 2 management representatives; may be a union person
(d) 3 management representatives; may be a management person

18. A, B, C and D are sitting around a table and discussing their trades. A sits opposite to the cook. B sits right to the barber. The washer man is on the left of the tailor. D sits opposite to C. What are the trades of A and B?
(a) Tailor and Barber (b) Barber and Cook
(c) Tailor and Cook (d) Washer man and Cook

19. P, Q, R, S and T are sitting around a circle facing towards the centre. R is immediate left of T. P is between S and T. Who is immediate left of R?

	(a) P (b) Q (c) S (d) Data insufficient
20.	Six friends A, B, C, D, E and F are sitting around a circle facing towards the canter. A sits opposite to D. C is between A and B. F is between E and A. Who is to the immediate left of B? (a) C (b) D (c) C or D (d) Data insufficient
21.	Five persons are standing in a line in a ceremony. One of the two persons standing at the extreme ends is a general Manager and the other one is a Senior Manager. The Deputy General Manager is standing to the right of the Assistant General Manager. A Deputy Manager is to the left of the Senior Manager. The Assistant General Manager is standing between the General Manager and the Deputy General Manager. Counting from the left, what is the position of the Deputy General Manager? _____
22.	Five students participated in the scholarship examination. Sudha scored higher than Puja. Kavita scored lower than Suma but higher than Sudha. Mamta scored between Puja and Sudha. Which rank does Mamta holds in the result of examination? _____
23.	In a class of 35 students, after annual examination, Kiran holds 7^{th} position from the bottom, whereas Mohan holds 9^{th} place from the top. Sohan is placed exactly in between Kiran and Mohan. What is Kiran's position from Sohan? _____
24.	In a queue of children, Kashish is fifth from the left and Mona is sixth from the right. When they interchange their places among themselves, Kashish becomes 13^{th} from the left. Then what will be the Mona's position from the right? _____
25.	In a row at a bus stop, A is 7^{th} from the left and B is 9^{th} from the right. Both of them interchange their positions and thus A becomes 11^{th} from the left. How many people are there in that row? _____
26.	Six boys A, B, C, D, E and F are marching in a line. They are arranged according to their height, the tallest being at the back and the shortest in front. F is between B and A. E is shorter than D but taller than C who is taller than A. E and F have two boys between them. A is not the shortest among them. If the shortest is considered as 1^{st} position, then C holds _____ position.
27.	Five golfers C, D, E, F and G play a series of matches in which the following are always true of the results. Either C is the last and G is the 1^{st} or C is the first and G is the last. D finishes ahead of E. Every golfer plays in and finishes every match. There are no tries in any match, i.e. no two players ever finish in the same position in a match. If exactly 1 golfer finishes between C and D, then at what position E finishes? _____
28.	Five horses ran in the race. There were no ties. Sikandar did not come first. Star was neither first nor last. Mughal Glory came in one place after Sikandar. Zozo was not second. Rangila was two place below Zozo. At what position did Sikandar finishes the race? _____
29.	In a row of boys, Suresh is 7^{th} from the left, and Kamal is 12^{th} from the right. If they interchange their positions, Suresh becomes 22^{nd} from the left. How many boys are there in the row? _____
30.	In a queue, Sita is 14^{th} from the front, while Gopal is 30^{th} from behind, and Nimayun is just in the middle of the two, and occupy 20^{th} position from the front. How many persons are there in the queue? _____
31.	A, B and C are waiting in a queue meant for persons for using ATM machine. There are 5 persons between A and B, and 8 persons between B and C. If there are 3 persons ahead of C and 21 persons behind A, then what is the maximum number of persons in the queue? _____
32.	In a row of ten boys, when Rohit was shifted by two places towards the left, he became 7^{th} from the left end. What was his earlier position from the right end of the row? _____
33.	A seven member panel is sitting in a row. A is in between D and F. C is in between F and G. G is in between C and E. D is in between B and A. If counting from the left, at what position F is sitting? _____
34.	A sport week was organised in an institute from 9^{th} to 16^{th} of a month, 9^{th} being a Wednesday. During this period, various sports were organised like cricket, badminton, table-tennis, kabaddi, hockey and football and they were played, one game being played on each day. Hockey was not played on the closing day of sport week. Table-tennis was played on the previous day of cricket game. Football was not played either on Wednesday or Saturday. No game was played on Thursday and Sunday. Kabaddi was played on Monday. There is a gap of 2 days between cricket and football. How many days gap is there between the game of hockey and football? ___

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35. Manish ranked 16^{th} from the top and 29^{th} from the bottom among those who passed an examination. Six students did not participate in the examination and four failed in it. How many students were there in the class? _____

4.14 Puzzles

Puzzles consist of questions in which certain information was given as a clue and with the help of which the candidate is required to analyse the given items, and answer the question accordingly.

Example [GA-2010 (2 mark)]: A student is answering a multiple choice examination with 65 questions with a marking scheme as follows: (i) 1 mark for each correct answer, (ii) $-1/4$ for a wrong answer, (iii) $-1/8$ for a question that has not been attempted. If the student gets 37 marks in the test then the least possible number of questions the student has NOT answered is:
(a) 6 (b) 5 (c) 7 (d) 4
Solution (a): Let x, y, z be the number of question attempted correct, attempted wrong, not attempted, respectively. As total number of questions is 65, so $x+y+z=65$ …(i). Also the student gets 37 marks in the test then $x(1)+y\left(-(1/4)\right)+z\left(-(1/8)\right)=37 \Rightarrow 8x-2y-z=296$ …(ii). $(i)\times 2+(ii) \Rightarrow 10x+z=426$ …(iii). As 1 mark for each correct answer and $10x$ gives a number which is multiple of 10 and close to 426 (as z is least possible number). 420 and 430 both are close to 426 and multiple of 10. As z is added to $10x$, then $10x$ must be 420. Thus (iii) $\Rightarrow 420+z=426 \Rightarrow z=6$.

Example [GA-2012 (2 mark)]: There are eight bags of rice looking alike, seven of which have equal weight and one is slightly heavier. The weighing balance is of unlimited capacity. Using this balance, the minimum number of weighing required to identify the heavier bag is
(a) 2 (b) 3 (c) 4 (d) 8
Solution (a): Let us divide the bags in three groups $A=A_1,A_2,A_3$, $B=B_1,B_2,B_3$, $C=C_1,C_2$.

	Case I	**Case II**	
1st Weighing between groups A and B	If $A=B$, then heavier bag is in group C.	If $A\neq B$ then either $A>B$ or $A<B$ and bags in group C are equal in weight.	
2nd Weighing	By weighing the bags in group C we can find which one among C_1 and C_2 is heavier.	If $A>B$, then weighing any two bags in group A we can find which one is heavier. If $A_1=A_2$ then A_3 is heavier. If $A_1>A_2$ then A_1 is heavier. If $A_1<A_2$ then A_2 is heavier.	If $A<B$, then weighing any two bags in group B we can find which one is heavier. If $B_1=B_2$ then B_3 is heavier. If $B_1>B_2$ then B_1 is heavier. If $B_1<B_2$ then B_2 is heavier.

So two is the minimum number of weighing required to identify the heavier bag.

Example [GA-2011 (2 mark)]: A transporter receives the same number of orders each day. Currently, he has some pending orders (backlog) to be shipped. If he uses 7 trucks, then at the end of the 4^{th} day he can clear all the orders. Alternatively, if he uses only 3 trucks, then all the orders are cleared at the end of the 10^{th} day. What is the minimum number of trucks required so that there will be no pending order at the end of the 5^{th} day?
(a) 4 (b) 5 (c) 6 (d) 7
Solution (c): Let each truck can carry x number of units in a truck; and daily demand order are y number of units; let p number of units are pending orders (backlog) to be shipped; and . If 7 trucks are used, then at the end of the 4th day all the orders are cleared, i.e. $7\times x\times 4=4y+p \Rightarrow 28x=4y+p$ …(i). If 3 trucks are used, then all the orders are cleared at the end of the 10th day, i.e. $3\times x\times 10=3y+p \Rightarrow 30x=10y+p$ …(ii). Solving (i) and (ii) in terms of x, we

get $y = x/3$ and $p = 80x/3$. Now if there will be no pending order at the end of the 5th day then let n be the number of trucks are used, so we have $n \times x \times 5 = 5y + p \Rightarrow 5nx = 5 \times (x/3) + (80x/3)$ $\Rightarrow 5n = 85/3 \Rightarrow n = 5.67$. As n must be an integers so we choose $n = 6$, as for $n = 5$ the pending order will not cleared at the end of the 5th day.

Example [GA-2015 (2 mark)]: The head of a newly formed government desires to appoint five of the six selected members P, Q, R, S, T, and U to portfolios of Home, Power, Defence, Telecom and Finance. U does not want any portfolio if S gets one of the five. R wants either Home or Finance or no portfolio. Q says that if S gets either Power or Telecom then she must get the other one. T insists on a portfolio if P gets one. Which value is the valid distribution of portfolios?
(a) P-Home, Q-Power, R-Defence, S-Telecom, T-Finance
(b) R-Home, S-Power, P-Defence, Q-Telecom, T-Finance
(c) P-Home, Q-Power, T-Defence, S-Telecom U-Finance
(d) Q-Home, U-Power. T-Defence. R-Telecom P-Finance
Solution (b): Option (c) is not correct as U does not want any portfolio if S gets one of the five. Options (a) and (d) are not correct as R wants either Home or Finance or no portfolio. So we are left with option (b) which satisfies all the criteria.

Exercise 4.14

Choose the correct option were options are given for the question. Fill the calculated value in appropriate place, where it is required for the question.

1.	Mr. X has bought four cars, Maruti, Cealo, Vento and Honda, for their four daughters (A, B, C and D). A will not get the Cealo unless B gets the Maruti and D gets the Vento. B will not get the Vento unless C gets the Honda and A gets the Maruti. D will not get the Honda unless A gets the Cealo and B gets the Maruti. A will not get the Maruti unless C gets the Honda and D gets the Vento. B will not get the Maruti unless A gets the Honda and D gets the Vento. A will not get the Honda unless B gets the Cealo and C gets the Maruti. C will not get the Honda unless B gets the Cealo and A gets the Vento. A will not get the Vento unless B gets the Honda and D gets the Cealo. C will not get the Maruti unless D gets the Cealo. Based on the above information, what will each daughter get? (a) A : Maruti; B : Cealo; C : Honda; D : Vento (b) A : Vento; B : Honda; C : Maruti; D : Cealo (c) A : Maruti; B : Vento; C : Honda; D : Cealo (d) A : Cealo; B : Maruti; C : Honda; D : Vento
2.	Amit can speak in English and Spanish; Bhola can speak in Hindi and English; Chintu can speak in Spanish and Hindi; Deepak can speak in Hindi and Gujarati; Eklavya, a native Spanish, can also converse in Gujarati. If you are brought into them, then to be understood by the maximum number of the original five, you should be fluent in which two languages? (a) Hindi and Spanish (b) Spanish and French (c) French and Hindi (d) French and English
3.	In order to conduct the work at construction site it is necessary to have a minimum of three workers each day. There are five workers who work on part time basis. Amit can work on Mondays, Wednesdays and Fridays. Bhawna cannot report for work on Wednesdays. Chinmay can report for work on Tuesdays and Wednesdays only. Dharmendra cannot work on Fridays. Ehtisan is available anytime except on the first Monday and Thursday of the month. During which day of the week, might it be impossible to conduct the work at construction site? Note that the construction site remains closed on Saturday and Sundays. (a) Tuesday (b) Wednesday (c) Thursday (d) Friday
4.	Professor Pant is forming five-person special group for his project. The group must contain one team-leader, two computer engineers and two electrical engineers. P, Q and R are possible computer engineers. R, S and T are possible team-leaders. U, V and W are possible electrical engineers. Also, P and R prefers to work with each other in the same team. T prefers to work

only if V works. How many different possible groups, Professor Pant can make?
(a) 6 (b) 7 (c) 8 (d) 9

5. India, South Africa, Australia and New Zealand qualify for semi-finals in World Cup – 2015. Amit, Sanjeev, Jitendra made the following statements on who will win the world cup final: Amit said either India or New Zealand will definitely win; Sanjeev said he is confident that India will not win; Jitendra said he is confident that neither New Zealand nor Australia will win; When the result came, it was found that only one of the above three had made a correct statement. Who has made the correct statement and who has won the contest?
(a) Amit, Australia (b) Jitendra, India
(c) Sanjeev, South Africa (d) Sanjeev, Australia

6. Aman, Babita, Chintu and Ehtisaan each live in an apartment. Their apartments are arranged in a row numbered 1 to 4 from left to right. Also, one of them is the landlord. If Chintu's apartment is not next to Babita's apartment, then the landlord is Aman and lives in apartment 1. If Aman's apartment is right of Chintu's apartment, then the landlord is Ehtisaan and lives in apartment 4. If Babita's apartment is not next to Ehtisaan's apartment, then the landlord is Chintu and lives in apartment 3. If Ehtisaan's apartment is right of Aman's apartment, then the landlord is Babita and lives in apartment 2. Who is the landlord?
(a) Aman (b) Chintu (c) Babita (d) Ehtisaan

7. There are 4 films on Action, War, Love Story and Crime - directed by A, B, C and D, and produced by P, Q, R and S not in necessarily in the same order. The film directed by A is produced by S. The Action film is produced by P. The film on Crime is directed by C and is not produced by R. The Love Story film is directed by D. Who are the Director and the Producer of each films?
(a) Action-B-P; War-A-S; Love Story-D-R; Crime-C-Q
(b) Action-A-Q; War-B-S; Love Story-D-R; Crime-C-P
(c) Action-B-P; War-A-R; Love Story-C-S; Crime-D-Q
(d) Action-A-Q; War-B-R; Love Story-D-S; Crime-C-P

8. Four persons A, B, C and D are heading towards different directions from a playing ground. The following information of their movement was supplied: The heading roads were North Road, South Road, East Road and West Road; A did not took neither East nor South nor West road; B did not took neither West nor South road; C did not took South road; D did not took North road. What road did each of the prisoners take to make their escape?
(a) A: North, B : East, C : West, D : South (b) A: North, B : West, C : East, D : South
(c) A: North, B : East, C : South, D : West (d) A: North, B : West, C : South, D : East

9. You are locked inside a room with 6 doors - A, B, C, D, E, F. Out of which A, F and other one are entrances only; B and other two are exits only. You got a not inside the room in which it is written that, "You will be set free, if you pass through all 6 doors, each door once only and in correct order. Also, door A must be followed by door B or E, door B by C or E, door C by D or F, door D by A or F, door E by B or D and door F by C or D." In which order must you pass through the doors?
(a) CFDABE (b) DFCABE (c) CFDEAB (d) BACEFD

10. At the party there were 19 females, 12 males, 14 adults and 17 children. Then a person 'X' arrived and the number of different man-woman couples became equal to the number of different boy-girl couples. It is to be noted that if there were x boys and y girls at the party, then there would have been $x \times y$ boy-girl couples possible. Who is the person 'X'?
(a) Man (b) Woman (c) Girl (d) Boy

11. There is a family party consisting of two fathers, two mothers, two sons, one father-in-law, one mother-in-law, one daughter-in-law, one grandfather, one grandmother and one grandson. What is the minimum number of persons required so that this is possible?
(a) 5 (b) 6 (c) 7 (d) 8

12. Three men - Sameer, Chinmay and Lokesh - are married to Chetna, Babita and Tina, but not necessarily in the same order. Sameer's wife and Babita's Husband play Chetna and Tina's husband at game. No wife makes her husband as partner in the game. Chinmay does not play bridge. Who is married to Chinmay?

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(a) Chetna (b) Babita (c) Tina (d) Can't be determined

13. A family photo contained: one grandfather, one grandmother; two fathers, two mothers; six children, four grandchildren; two brothers, two sisters; three sons, three daughters; one father-in-law, one mother-in-law, one daughter-in-law, one son-in-law. What is the least number of people here?

(a) 16 (b) 12 (c) 10 (d) 8

14. A is the father of two children - B and D who are of different sexes. C is B's spouse. E is the same sex as D. B and C have the two children - F who is the same sex as B and G who is the same sex as C. E's mother, H who is married to L, is the sister of D's mother, M. E and E's spouse, I have two children - J and K who are the same sex as I. Note that no persons have married more than once. Also, there are more number of females than males. Can you tell how many males and females are there?

(a) 7, 8 (b) 8, 7 (c) 7, 6 (d) 6, 7

15. There are six cities A, B, C, D, E and F. A is not a hill station. B and E are not holy places. D is not an industrial city. A and D are not holy cities. A and B are not alike. Which two cities are all hill station, industrial centre and holy place?

(a) A, C (b) D, E (c) C, F (d) C, D

16. Anuj, Bhupesh, Chinmay, Deepak and Ehtissan travelled to five different cities of Kanpur, Lucknow, Banaras, Bhopal and Roorkee by five different modes of transports bus, train, airplane, bike and Car from Mumbai. The person who travelled to Banaras did not travel by Car. Chinmay went to Bhopal by bike and Bhupesh went to Lucknow by airplane. Deepak travelled by Car, whereas Ehtisaan travelled by train. Mumbai is not connected by bus to Banaras and Kanpur. Which person travels to which place and by which mode?

(a) Anuj – Roorkee – Bus; Bhupesh – Lucknow – Airplane; Chinmay – Bhopal – Bike; Deepak – Kanpur – Car; Ehtisaan – Banaras – Train
(b) Anuj – Banaras – Bus; Bhupesh – Roorkee – Airplane; Chinmay – Lucknow – Bike; Deepak – Bhopal – Car; Ehtisaan – Kanpur – Train
(c) Anuj – Roorkee – Train; Bhupesh – Lucknow – Bus; Chinmay – Bhopal – Airplane; Deepak – Kanpur – Bike; Ehtisaan – Banaras – Car
(d) None of these

17. Six students A, B, C, D, E and F have to deliver a speech during their morning prayer, one on each day from Monday to Saturday. A must deliver a day before E. C must not deliver on the day following the day on which F delivers. B must deliver on the day following the day on which F delivers. D must delivers on Friday only and should not be immediately preceded by B. E must delivers on the last day of the schedule. What is the order of their delivering of speeches from Monday?

(a) F, B, E, A, C, D (b) F, B, A, E, D, C (c) A, F, E, C, D, B (d) E, A, C, B, D, F

18. Eight Professors A, B, C, D, E, F, G and H deliver lectures at the institute. Each Professor delivers the lectures for an hour from Monday to Friday and the timings are from 9 AM to 1 PM and 2 PM to 6 PM; 1 PM to 2 PM is lunch break. On Saturday, the institute is open only in the morning, i.e. from 9 AM to 1 PM and each one deliver lectures for only half an hour. No other Professor delivers the lecture before professor B and after Professor F. Professor H comes immediately after lunch break and is followed by Professor C. Professor D comes in the same order as Professor A in the afternoon session. Professor E prefers to visit after Professor D visited. When Professor G starts delivering lecture on Saturday?

(a) 9 AM (b) 9:30 AM (c) 10:00 AM (b) 10:30 AM

19. From among six boys P, Q, R, S, T and U, and five girls, V, W, X, Y, and Z, a team of six is to be selected under the following conditions: P and S to be together. R cannot go with Y. Y and Z have to be together. Q cannot be teamed with T. S cannot go with V. Q and X have to be together. R and W have to ne together. If including V, the team has three girls, the members are:

(a) Q, R, U, W, X (b) P, S, T, Y, Z (c) P, S, Q, Y, Z (d) Q, U, X, Y, Z

20. There is a group of six persons, P, Q, R, S, T and U from a family. They are Contractor, Teacher, Judge, Director, Producer and Anchor. The Producer is the grandfather of U who is a Contractor. The Teacher S is married to P. R, who is a Director, is married to the Judge. Q is the

mother of U and T. There are two married couples. The professions of P, Q and T are _____, respectively.
(a) Anchor, Producer and Judge (b) Judge, Producer and Anchor
(c) Producer, Anchor and Judge (d) Producer, Judge and Anchor

21. In a school there were five teachers. A and B were teaching Hindi and English. C and B were teaching English and Geography. D and A were teaching Mathematics and Hindi. E and B were teaching History and Hindi. B and C were teaching Geography and Hindi. Which subject is taught by all the teachers?
(a) Hindi (b) English (c) Geography (d) Maths

22. Four men A, B, C and D are friendly with four girls P, Q, R, and S. P and R are friends. C's girlfriend does not like P and R. Q does not care for C. B's girlfriend is friendly with P. P does not like A. Which of the following the correct pair of couples?
(a) A – Q; D – P; C – S; B – R (b) A – P; D – Q; C – S; B – R
(c) A – P; D – Q; C – R; B – S (d) A – P; D – R; C – Q; B – S

23. On a shelf, six cups are placed side by side labelled as P, Q, R, S, T and U. Q, R, T and U are blue, while others have red colour. P, S and Q are new cups, while the rest are old cups. P, R and Q are made of steels, while the rest are made of copper. Which two cups are old made of copper and have blue covers?
(a) Q, R (b) R, S (c) R, T (d) T, U

24. Five men A, B, C, D and E read a book. The one who reads first gives it to C. The one who reads last had taken from A; B was not the first or last to read. There were two readers between E and A. What is the sequence from first to last who read the book?
(a) E, B, C, D, A (b) E, C, B, A, D (c) D, A, E, C, B (d) A, D, C, B, E

25. Six movies P, Q, R, S, T and U are to be shown in a span of seven days from Sunday to Saturday, with only one movie on each day. Movie P should not be shown on Thursday. Movie R should be shown immediately after U. There should be a gap of two days between the movies T and S. One day there will be no movie (Friday is not that day), just before that day movie S will be shown. Movie Q should be shown on Tuesday and should not be followed by movie S. If 'X' represent 'no movie has shown on a day' then what is the sequence of movies shown from Sunday to Saturday?
(a) R, X, Q, T, U, S, P (b) S, X, Q, T, U, R, P
(c) X , S, Q, T, U, R, P (d) S, Q, X, T, U, P, R

26. An institute has to conduct lectures on six different subjects: A, B, C, D, E, and F, from July 22 to 28. Lecture should start with subject A. July 23, being Sunday, should be a holiday. Lecture on subject D should be on the previous day of the lecture on subject E. Lecture on subjects should end with F. Lecture on subject B should be immediately after the holiday. There should be a gap of one day between the lectures on subject C and E. If 'X' represent 'no lecture delivered on a day' then what is the sequence of lectures delivered from Saturday to Friday?
(a) A, X, D, B, C, E and F (b) A, B, X, C, D, F and E
(c) A, X, B, C, D, E and F (d) E, X, B, C, D, A and F

27. A team of five is to be selected from among five boys B1, B2, B3, B4 and B5, and four girls G1, G2, G3 and G4. B1 and G4 have to be together. G1 cannot be put with G3. B4 and G2 cannot go together. B3 and B5 have to be together. G3 cannot be put with B2. If two of the members have to be boys, the team will consist of
(a) B1,B2,G1,G2,G4 (b) B1,B3,G3,G2,G4 (c) B1,B5,G1,G2,G4 (d) B1,B5,G3,G2,G4

28. There are five men, G, H, I, J and K, and six women M, N, O, P, Q and R. G, H and O are sport persons. I, J, M, N and P are actors, and the rest are helpers. G, M and R have to be together. H cannot go with J or O. K and N have to be together. I and Q have to be together. J and M cannot go together. I cannot go with N. If the team is to consist of one sport person, three actors, and one male helper, the members of the team are
(a) G, J, M, P and R (b) I, J, O, P and Q (c) J, K, N, O and P (d) J, K, N, O and I

29. Pankaj and Sandhya has three children: Geeta, Vimla and Suresh. Suresh married Jyoti, the eldest daughter of Mr. and Mrs. Sharma. The boys married their youngest daughter to the eldest son of Mr. and Mrs. Verma, and they had two children named Ankit and Sushil. The Sharmas

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have two more children Raman and Deepa. Vineet and Amit are sons of Suresh and Jyoti. Sita is the daughter of Ankit. The surname of Sita is _____. Vineet is _____ to the father of Jyoti. Mrs. Sharma is _____ to Suresh.

(a) Sharma, Son-in-law, Mother-in-law (b) Verma, Son-in-law, Daughter-in-law
(c) Verma, Grandson, Mother-in-law (d) Sharma, Grandson, Daughter-in-law

30. P, Q, R, S, T and U are travelling in a bus. There are two actors, two managers, one photographer, and one writer in the group. The photographer P is married to S who is a actor. The writer is married to Q, who is of the same profession as that of U. P, R, Q and S are two married couples and nobody in the group has same profession. U is brother of R. _____ are managers and _____ are actors. Also, R is _____ of U?

(a) Q, U; S, T; brother (b) S, T; Q, U; sister
(c) Q, U; S, T; brother or sister (d) S, T; Q, U; brother

31. There are six teachers, P, Q, R, S, T and U, in a college. Each of the teachers teaches two subjects, one compulsory subject and the other optional subject. S's optional subject was A, while three other have it as compulsory subject. T and U have B as one of their subjects. U's compulsory subject is E, which is an optional subject for both R and T. A and D are P's subjects, but in terms of compulsory and optional subjects, they are just reverse of those of S's. C is an optional subject for only one of them. A as a compulsory subject is taught by _____. D as a compulsory and optional subject is taught by _____ and _____, respectively. B as a compulsory subject taught by _____.

(a) P,Q,R; S,O; T (b) P,Q,S; R,O; T (c) P,T,R; S,O; Q (d) P,Q,O; S,R; T

32. A, B, C, D and E are the five members of a family. They have their birth dates from January to May, each member in one of these months. Each one likes one particular item for his/her birthday out of Bengali sweets, cakes, juices, milk products, and dry fruits. The one who like juices is born in the month which is exactly middle in the month given. D does not like milk products, but brings cakes for A in February. E who is fond of Bengali sweets is born in the next month immediately after C. C does not like dry fruits or milk products. Which of the following is correct combination of 'person – born in which month – choice'?

(a) A – February – Cakes; C – March – Juice; D – January or May – Milk Products
(b) A – February – Cakes; C – March – Juice; D – January or May – Dry fruits
(c) A – March – Cakes; C – February – Juice; D – January – Dry fruits
(d) A – February – Juice; C – March – Cakes; D – May – Dry fruits

33. A, B, C, D, E and F are the six students procuring their Master's degree in six different subjects, S1, S2, S3, S4, S5 and S6. Two of them stay in hostel, two stay as paying guest (PG), and the remaining two stay at their home. C does not stay as PG and studies S3. The students studying S5 and S2 do not stay as PG. E studies S6 and D studies S4. F and D stay in hostel. E stays as PG and B stays at home. A stays in _____ and studies _____. B studies _____.

(a) Home; S1; S5 (b) PG; S5; S1 or S2 (c) Home; S1; S2 (d) PG; S1; S5 or S2

34. Raman, Chitra, Ajay, and Tanya are students of a school. Three of them stay far from the school and one near it. Two study in class XII, one in class XI, and one in class X. They study Physics, Mathematics, Chemistry and Biology. One is good at all the four subjects, while another is weak in all of these. Raman stays far from the school and is good in Mathematics only and stays close to the school. Neither of these two nor Ajay studies in class X. One who is good at all the subjects studies in class XI. The students who are good and weak in all the subjects are _____ and _____, respectively. Ajay stays _____ from the school.

(a) Ajay, Tanya, far (b) Tanya, Ajay, near
(c) Ajay, Tanya, near (d) Tanya, Ajay, far

35. There are six friends A, B, C, D, E and F. Each one is proficient in one of the games, namely Basketball, Badminton, Volleyball, Cricket, Hockey and Tennis. Each owns a different colouBlue cycle, namely Purple, Yellow, Green, Black, White and Blue. D plays Tennis and owns a Purple colouBlue cycle. C does not play either Hockey or Cricket and owns neither White nor Purple colouBlue cycle. E owns a Black cycle and plays Basketball. B does not play Hockey; he owns a Blue colouBlue cycle. A plays Volleyball and owns a Green cycle. Which of the following combination 'person – cycle colour – game' is correct?

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(a) B – Cricket – White; C – Hockey – Yellow; F – Badminton – Blue
(b) B – Hockey– Blue; C – Badminton – White; F – Cricket – Yellow
(c) B – Badminton – White; C – Cricket– Yellow; F – Hockey – Blue
(d) B – Cricket – Blue; C – Badminton – Yellow; F – Hockey – White

36. Five events P, Q, R, S, and T are to be organised from Monday to Friday of a week on the occasion of marriage. On each day, only one event will be organised. Events S or T should not be either the first or the last to be organised. Event T should be immediately followed by event R. Event Q should be staged immediately after event S. One event is organised between events P and Q. Which of the following is the correct sequence of events to be organised?
(a) P, S, Q, R, T (b) Q, S, P, T, R (c) P, S, Q, T, R (d) P, Q, S, T, R

37. From among five contractors A, B, C, D and E, four designers, G, H, K and L, and six workers, M, N, O, P, Q and R, a team consists of two contractors, one designer, and four workers is to be selected. Of these, A, B, G, H, O, P and Q are females, and the rest are males. If a male contractor is selected then no female workers will be selected. If a male designer is selected then no female contractor will be selected. There shall not be more than two male workers in any team. Which of the following teams should not be accepted?
(a) A, B, G, M, N, O and P (b) A, B, H, M, O, P and Q
(c) A, B, H, M, R, P and Q (d) A, B, K, N, R, P and Q

38. Eight students, P, Q, R, S, T, U, V and W, are planning to enjoy boat racing. There are only two boats. One boat can accommodate maximum five and minimum four students. P will sit in the same boat in which S is sitting, but W is not in the same boat. Q and R cannot sit in the same boat in which S is sitting. U will sit in the boat of four people only along with P and E, but certainly not with V. If W and V are sitting in the same boat, who are other two students sitting in the same boat?
(a) Q and R (b) R and S (c) Q and S (d) T and Q

39. Eight events, A, B, C, D, E, F, G and H, are to be operated daily. On any one day, except for the fifth day of a month, only three of the events must be the ones that were operated on the previous day. If event A is to be operated on a day, event G cannot be operated on that day. If event B is to be operated on a day, event E must be one of the events to be operated after event B. If event C is to be operated on a day, event G must be one of the events to be operated after event C. The last event to be operated on any day must be either event D or F. Which of the following could be the set of events to be operated on the first day of a month?
(a) G, B, C, E and D (b) F, B, D, E and H (c) E, F, C, G and D (d) A, C, G, D and F

40. P, Q, R, S, T and U are six members in a family, in which there are two married couples. T, who is a teacher, married to the doctor who is the mother of R and U. Q, who is the contractor, married to P. P has a son and a grandson. Of the two married ladies, one is a housewife. There is also one dancer and one male doctor in the family. P is _____ to R who is _____ to U. The grand daughter in the family is a _____. _____ are the females in the family.
(a) Mother; brother; contractor; P, S and R
(b) Grandmother; either brother or sister; dancer; data insufficient
(c) Mother; sister; dancer; P, S and U
(d) Grandmother; sister; dancer; P, S, R

41. There is a family of six members A, B, C, D, E and F. There are two married couples in the family and the family members represent three generations. Each member has a distinct choice of a colour among purple, green, yellow, black, red and white. No lady member likes either purple or red. C, who likes yellow colour, is the daughter-in-law of E. B is brother of F and son of D and likes white. A is grandmother of F who does not like black. The husband has a choice of purple colour; his wife likes green. A likes _____ colour. F is _____ to B. The married couples are _____.
(a) black; brother; A & D and C & E (b) green; brother; A & E and C & D
(c) black; sister; A & C and D & E (d) green; either brother or sister; A & D and C & E

42. P, Q, R, S, T and U are six members in a family in which there are two married couples. S is brother of U. Both S and U have lesser income than Q. Q is mother of S and earns less than T. R, who is a female, is neither earns minimum nor maximum in the family. T earn less than R.

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The grandfather in the family is earns maximum in the family. T is _____ to U. R is _____ to S. _____ are married couples. _____ is the second person in the family who earns more than others.
(a) brother; grandmother; P & R and Q & T; R
(b) father; grandfather; P & Q and R & T; P
(c) brother; grandfather; P & Q and R & T; P
(d) father; grandmother; P & R and Q & T; R

43. A, B, C, D, E and F are six members of a group of which three are male and three are female. There are two contractors, two engineers, one lawyer and one teacher in the group. B, E, A and C are two married couples, and no person in this group has the same profession. E, who is a lawyer in white dress, married a male engineer in blue dress. Colour of the dresses of both the husbands and that of both the wives is the same. Two persons have white dress, two have blue, and the remaining two each has brown and black. A is a male contractor whose sister D is also an contractor. B is a teacher. A is husband to _____. The married ladies are _____. The colour of F's dress is _____.
(a) D; D & E; brown
(b) B; B & E; either brown or black
(c) B; B & E; brown
(d) D; D & E; black

44. In a family of six persons, A, B, C, D, E and F, there are people from three generations. Each person has separate profession, and also they like different colours. There are two couples in the family. F is an actor, and his wife is neither a contractor nor like the purple colour. Engineer likes green colour, and his wife is a professor. A is the mother-in-law of B, and she likes red colour. C is the grandfather of D, and D, who is a principal, likes orange colour. E is the granddaughter of A, and she likes black colour. E's mother likes white colour. C is a/an _____. The two couples are _____. The actor like _____ colour.
(a) engineer; A & C and F & B; purple
(b) doctor; A & B and F and C; green
(c) engineer; A & B and F & C; purple
(d) doctor; A & C and F and B; green

45. One of the four people, Chinmay, his wife Monika, their son Manoj and their daughter Shilpa, is a singer and another is a dancer. Chinmay is older than his wife and Manoj is older than his sister. If the singer and the dancer are the same sex, then the dancer is older than the singer. If neither the singer nor the dancer is the parent of the other, then the singer is older than the dancer. If the singer is a man, then the singer and the dancer are the same age. If the singer and the dancer are of opposite sex then the man is older than the woman. If the dancer is a woman, then the dancer is older than the singer. Shilpa is a _____. Dancer is an occupation of _____.
(a) Shilpa; either Chinmay or Monika
(b) Monika; Chinmay
(c) Shilpa; Monika
(d) Monika; either Manoj or Shilpa

46. Mr. and Mrs. Sharma & Mr. and Mrs. Verma competed in a Chess tournament. Of the three games played. In only the first game were the two players married to each other. The men won two games and the women won one game. The Sharmas won more games than the Vermas. Anyone who lost a game did not play a subsequent game. Who did not lose a game?
(a) Mr. Sharma (b) Mrs. Sharma (c) Mr. Verma (d) Mrs. Verma

47. There are 4 mugs placed upturned on the table. Each mug have the same number of marbles and a statement about the number of marbles in it. The statements are: Two or Three, One or Four, Three or One, One or Two. Only one of the statement is correct. How many marbles are there under each mug?
(a) One (b) Two (c) Three (d) Four

48. Suppose five packets of rice are weighed two at a time in all possible ways. The weights in kg are 110, 112, 113, 114, 115, 116, 117, 118, 120, and 121. How much does each packet of rice weigh in increasing order?
(a) 54, 56, 58, 59, 62
(b) 52, 56, 58, 59, 64
(c) 54, 55, 58, 60, 62
(d) 54, 56, 57, 60, 62

49. Shilpa got chocolates to give her friends on her Birthday. If she gives 3 chocolates to each friend, one friend will get only 2 chocolates. Also, if she gives 2 chocolates to each friends, she will left with 15 chocolates. How many chocolates Shilpa got on her Birthday? How many friends are there?

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(a) 47, 16 (b) 48, 17 (c) 46, 15 (d) 49, 15

50. If today is Wednesday, what is one day before the day, after the day, three days after the day before yesterday?
(a) Tuesday (b) Wednesday (c) Thursday (d) Friday

51. There is a safe with a 5 digit number as the key. The 4th digit is 4 greater than the second digit, while the 3rd digit is 3 less than the 2nd digit. The 1st digit is thrice the last digit. There are 3 pairs whose sum is 11. What is the key? _____

52. A girl has a certain number of pets. All except two are dogs, all except two are cats and all except two are goats. How many pets does this girl have? _____

53. A sheet of paper has statements numbered from 1 to 100. Exactly N of the statements on this sheet are false. How many statements are true? _____

54. A, B, C and D participated in a Pool competition. There are total of 15 balls. For each ball potted, the player will receive one point. They all will play each other once. A game will end when all the balls are potted. The winner will be the player who scored the most points. D finished with 18 points. A finished with odd number of points. C beat D by 5 points in the match between them. There was one point difference in match between B and A. A scored twice as many points as C in their game. D scored one point less against A than he did against C. C scored 7 points against B. Who won the competition?
(a) A (b) B (c) C (d) D

55. There are 5 houses (owned by 5 persons, A, B, C, D and E) in 5 different colours. These 5 owners drink a certain beverage, smoke a certain brand of cigar and keep a certain pet. No owners have the same pet, smoke the same brand of cigar or drink the same drink. The Indian lives in a red house. The Lankan keeps dogs as pets. The Chinese drinks tea. The green house is on the immediate left of the white house. The green house owner drinks coffee. The person who smokes Pall Mall rears birds. The owner of the yellow house smokes Dunhill. The man living in the house right in the centre drinks milk. The Russian lives in the first house. The man who smokes blend lives next to the one who keeps cats. The man who keeps horses lives next to the man who smokes Dunhill. The owner who smokes Blue Master drinks beer. The German smokes Prince. The Russian lives next to the Blue House. The man who smokes blend has a neighbour who drinks water. Who keeps fish?
(a) Indian (b) German (c) Russian (d) Chinese

56. There are 70 employees working in a company of which 30 are females. Also, 30 employees are married. 24 employees are above 25 years of age. 19 married employees are above 25 years, of which 7 are males. 12 males are above 25 years of age. 15 males are married. How many unmarried females are there and how many of them are above 25?
(a) 15, 0 (b) 20, 5 (c) 10, 0 (d) 10, 5

57. If a bear eats 65 kg of fish every day except every 6th day which it only eats 45 kg of fish. If the bear continues this, how many pounds of fish will it eat in 200 days? _____

58. To reach a city 'X', I will have to travel overland by foot from the coast. On a trek like this, each person can only carry enough rations for five days and the farthest we can travel in one day is 30 km. Also, the city is 120 km from the starting point. What I am trying to figure out is the fewest number of persons, including myself, that I will need in our Group so that I can reach the city, stay overnight, and then return to the coast without running out of supplies. How many persons (including me) will need to accomplish this mission? _____

59. A person has divided his gold coins among his 5 sons, 5 daughters and a wife. He first gave one coin to wife. He then gave $1/5^{th}$ of the remaining to the elder son. Now he gave one coin to the wife and $1/5^{th}$ of the remaining to second son and so on. After giving coins to 5^{th} son, he divided the remaining coins among five daughters equally. All should get full coins. Find the minimum number of coins he has? _____

60. A woman took a certain number of eggs to the market and sold some of them. The next day, at her poultry farm, the number left over had been doubled, and she sold the same number as the previous day. On the third day the new remainder was tripled, and she sold the same number as before. On the fourth day the remainder was quadrupled, and her sales the same as before. On the fifth day what had been left over were quintupled, yet she sold exactly the same as on all the

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	previous occasions and so disposed of her entire stock. What is the smallest number of eggs she could have taken to market the first day, and how many did she sell daily? Note that the answer is not zero. (a) 103, 60 (b) 100, 40 (c) 103, 40 (d) 100, 60
61.	In the General meeting of a society, Arun said, "The repairs to the society will come to a total of ₹3120 and I propose that this amount should be met by the members, each paying an equal amount." The proposal was immediately agreed. However, four members of the society chose to resign, leaving the remaining members to pay an extra Rs 26 each. How many members did the society originally have? _____
62.	There are 10 boxes containing 10 balls each. 9 boxes contain 10 balls of 10 kg each and one box contains 10 balls of 9 kg each. You can remove balls from the boxes. All balls are of same size and colour. Tool is available for proper weighing and a pen is also available. Using the tool, the minimum number of weighing required to identify the box having 9 kg balls is _____
63.	12 members were present at a board meeting. Each member shook hands with all of the other members before & after the meeting. How many hand-shakes were there? _____
64.	In the first One-day International Cricket match between India and Australia at Lords, the bowling honour in the Indian team was shared by Jadeja, Kumar and Binni. Either Kapil took half the wickets or one of the players was run out. Either Kapil took 5 wickets and Binni took 3 or Kumar took one more than Binni. The sum of Kapil's victims and twice of Kumar's victims is one more than three times Binni's victims. Total number of wickets taken by Kumar and Binni is _____.
65.	Of the 120 people in the room, 3/5 are women. If 2/3 of the people are married, the maximum number of women in the room who could be unmarried is _____.
66.	What is the four-digit number in which the first digit is 1/3 of the second, the third is the sum of the first and second, and the last is three times the second? _____
67.	In an examination, three problems A, B and C were posed. Among the students there were 25 who solved at least one problem each. Of all the students who did not solve problem A, the number who solved B was twice the number who solved C. The number of participants, who solved only problem A, was one more than the number who solved problem A and at least one other problem. Of all students who solved just one problem, half did not solve problem A. How many students solved only problem B? _____
68.	Buffalo produces 10 litres of milk daily, a cow produces 1 litre of milk daily, and sheep produce 1/4 litre of milk daily. I need exactly 100 litres of milk from exactly 100 different animals daily. Also, I should use all 3 types of animals. If I have to use maximum number of buffalos then how many sheep should I use? _____
69.	If the number of Eggs I have (i) is a multiple of 5, it is a number between 1 and 19; (ii) is not a multiple of 8, it is a number between 20 and 29; (iii) is not a multiple of 10, it is a number between 30 and 39. How many Eggs do I have? _____
70.	Shahrukh and Amir, together have more than 10 but fewer than 30 bodyguards. One day, one of the bodyguards, Salman, decided to leave Shahrukh and join Amir. Now both of them had the same number of bodyguards. Eventually, Salman re-joined Shahrukh. Also, Abhishek decided to leave Amir and join Shahrukh. Now, both of them had a prime number of bodyguards. How many bodyguards did both have now? _____
71.	There are 8 secret agents each know a different piece of secret information. They can telephone each other and exchange all the information they know. After the telephone call, they both know anything that either of them knew before the call. What is the minimum number of telephone calls needed so that all of them know everything? _____
72.	In the town called Baheri, the following facts are true: No two peoples have exactly the same number of hairs. No people have exactly 2025 hairs. There are more peoples than there are hairs on the head of any one people. What is the largest possible number of the peoples in Baheri? _____
73.	My father goes to work by a bus. One day he falls asleep when the bus still has twice as far to go as it has already gone. Halfway through the trip he wakes up as the bus bounces over some speed breaker. When he finally falls asleep again, the bus still has half the distance to go that it

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	has already travelled. Fortunately, My father wakes up at the end of his trip. What portion of the total trip did My father sleep? _____
74.	My family went on a holiday to a hill station. It rained for 13 days. But when it rained in the morning, the afternoon was lovely. And when it rained in the afternoon, the day was preceded by clear morning. Altogether there were 11 very nice mornings and 12 very nice afternoons. How many days did my holiday last? _____
75.	Thirty six vehicles are parked in a parking lot in a single row. After the first car, there is one scooter. After the second car, there are two scooters. After the third car, there are three scooters and so on. What is the number of scooters in the second half of the row? _____

Answers Keys

Answer Keys: Exercise 4.1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	c	d	d	b	c	c	d	d	d	d	a	b	a	a	d	c	b	a	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
d	c	c	b	c	d	d	a	a	d	c	b	d	b	d					

Answer Keys: Exercise: 4.2

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	c	c	d	b	d	d	c	c	d	b	d	a	b	d	c	b	a	a	b
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
c	b	d	c	b	a	c	a	b	c	c	d	b	c	b					

Answer Keys: Exercise: 4.3

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	b	c	d	c	a	d	b	d	a	b	a	c	c	c	b	c	b	d	a
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
a	b	c	c	b	d	a	b	d	b	d	c	a	b	5					

Answer Keys: Exercise: 4.4

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	a	b	a	b	b	d	c	a	a	c	c	d	b	a	d	c	b	d	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
d	b	a	c	a	c	c	b	a	c	a	b	c	d	c					

Answer Keys: Exercise: 4.5

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	d	d	b	c	c	b	c	d	c	d	a	d	a	b	b	a	b	c	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
b	a	b	a	c	a	b	c	c	d	a	a	c	d	a					

Answer Keys: Exercise: 4.6

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	a	d	b	b	b	c	d	c	c	b	c	d	b	d	b	d	a	b	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
d	d	b	d	b	a	b	c	c	a	c	a	c	d	a					

Answer Keys: Exercise: 4.7

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
d	c	d	a	b	c	b	a	c	d	c	a	a	a	a	b	d	c	c	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
b	d	c	a	b	a	c	d	c	d	c	d	b	a	a					

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Answer Keys: Exercise: 4.8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	b	d	c	d	a	a	b	a	d	c	c	b	d	a	d	d	c	d	a
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
c	a	b	b	c	c	b	c	c	c	d	b	a	a	c					

Answer Keys: Exercise: 4.9

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	d	b	b	b	b	c	b	c	a	a	a	a	a	b	d	b	b	c	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
a	a	b	a	c	a	b	d	d	c	a	b	c	b	b					

Answer Keys: Exercise: 4.10

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	d	a	b	c	c	a	a	b	b	a	c	c	b	b	d	a	d	b	a
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
a	d	a	c	c	b	a	d	c	b	d	a	b	c	c					

Answer Keys: Exercise: 4.11

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	b	d	c	b	b	a	c	a	a	c	c	b	d	d	b	a	c	a	b
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
a	c	b	d	d	5	5	313	225	25	50	10	2.6	10	5					

Answer Keys: Exercise: 4.12

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	c	a	b	d	c	c	b	d	b	a	c	d	d	d	a	a	c	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
c	c	c	d	b	a	a	a	d	d	a	d	c	a	c					

Answer Keys: Exercise: 4.13

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	b	c	b	d	a	a	c	c	b	a	a	b	b	d	c	a	c	b	c
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**					
3	4	10	8	19	4	4	4	33	55	40	2	4	5	54					

Answer Keys: Exercise: 4.14

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
b	a	c	c	d	b	a	a	a	c	a	a	d	d	c	a	b	b	b	d
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
a	a	d	b	b	c	a	c	c	c	a	b	d	a	d	c	d	a	c	b
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**		**52**	**53**	**54**	**55**	**56**	**57**		**58**
b	d	b	a	a	d	d	a	a	c	65292		3	1	a	b	a	12340		4
59		**60**	**61**	**62**	**63**		**64**	**65**	**66**		**67**	**68**	**69**	**70**	**71**	**72**		**73**	**74**
3121		a	24	1	132		7	40	1349		6	84	32	18	12	2025		0.5	18
75																			
15																			

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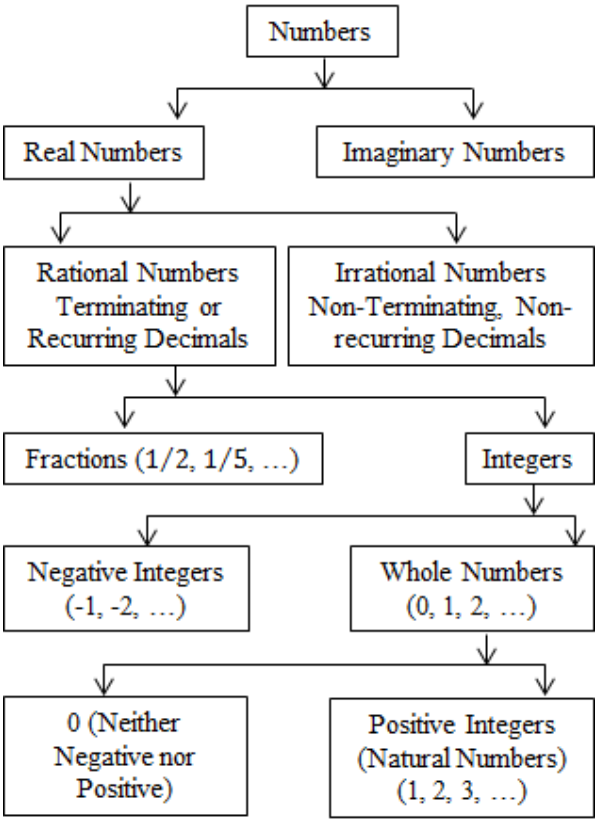
Chapter 5 : Numbers – I

A number is denoted by a group of digits called numerical. The place value of a digit in a number is the value it holds to be at the place in the number. The face value of a digit is the digit itself, at whatever place it may be. It is unchangeable and definite. But place value changes according to digit's place. Let us consider an example:

Example: Find the place value and face value of each digit in '357'.
Solution: As '7' is in one's place; '5' is in tens place; '3' is in hundreds place. So place value of '7' in 357 is $7\times1=7$; place value of '5' in 357 is $5\times10=50$; place value of '3' in 357 is $3\times100=300$. Also face value of 7, 5, 3 in '357' is 7, 5, 3, respectively.

5.1 Numbers System

The classification of numbers is shown in Fig. 5.1.


Numbers
Real Numbers
Imaginary Numbers
Rational Numbers Terminating or Recurring Decimals
Irrational Numbers Non-Terminating, Non-recurring Decimals
Fractions (1/2, 1/5, …)
Integers
Negative Integers (-1, -2, …)
Whole Numbers (0, 1, 2, …)
0 (Neither Negative nor Positive)
Positive Integers (Natural Numbers) (1, 2, 3, …)
Figure 5.1: Number System

- Any number is either **real number** (which can be plotted in real axis, for e.g. $-3.24, 1, 2.11$, etc.) or **imaginary number** (which can be plotted in imaginary axis, for e.g. $\sqrt{-2}, \sqrt{-3}$, etc.).
- Any real number is either **rational number** (which can be written in p/q form, where p, q are integers and their HCF is 1; for e.g. $-2, -1.343434..., -2/7, -3/4, 1/2, 5/3, 2.7272..., 3, 4$, etc.) or **irrational number** (which cannot be written in p/q form, where p, q are integers; for e.g. $-1.345687..., 2.34654...$, etc.)
- Any rational number is either a **fraction** (for e.g. $-2/7, -3/4, 1/2, 5/3$, etc.) or an **integer** (for e.g. $-3, -2, 0, 1, 3$, etc.)
- All counting numbers, i.e. $\{1, 2, 3, \cdots\}$ are called **natural numbers**.
- All counting numbers together with zero form the set of **whole numbers**. Thus, $\{0, 1, 2, 3, \cdots\}$ are whole numbers. Hence (i) 0 is the only whole number which is not a natural number; (ii) Every natural number is a whole number.
- All natural numbers, 0 and negatives of counting numbers. i.e., $\{\cdots -3, -2, -1, 0, 1, 2, 3, \cdots\}$ together form the set of **integers**.
- $\{1, 2, 3, \cdots\}$ is the set of all **positive integers**.
- $\{\cdots -3, -2, -1\}$ is the set of all **negative integers**.
- '0' is neither positive nor negative integer. So, $\{0, 1, 2, 3, \cdots\}$ represents the set of **non-negative integers**, while $\{\cdots -3, -2, -1, 0\}$ represents the set of **non-positive integers**.
- A number divisible by 2 is called an **even number**, e.g., $2, 4, 6, \cdots$.
- A number not divisible by 2 is called an **odd number**, e.g., $1, 3, 5, \cdots$ etc.

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- A number greater than 1 is called a **prime number**, if it has exactly two factors, namely 1 and the number itself. For e.g., $2,3,5,7,11\cdots$ are prime numbers. To check whether a number n is prime: (i) take the square root of a number, $x=\sqrt{n}$; round off x to the lowest integer (if it is not an integer); then check for the divisibility of n by all numbers bless than x. If there is no prime number less than x which divides n, then n will be a prime number. For e.g., let $n=83\Rightarrow x=\sqrt{83}=9.11\simeq 9$; as the prime numbers less than 9 are 1, 3, 5, 7 and $n=83$ is not divided by any of 1, 3, 5, 7; so 83 is a prime number.
  - An odd prime number p is expressed as the sum of two squares $p=x^2+y^2$, exactly if p leaves a remainder of 1 when it is divided by 4.
- Numbers greater than 1 which are not prime number are known as **composite numbers**, for e.g., $4,6,8,9,10\cdots$. It is to be noted that (i) 1 is neither prime nor composite; (ii) 2 is the only even number which is prime.
- Two numbers a and b are said to be **co-primes**, if their H.C.F. is 1. For e.g., $(2,3),(4,5),(7,9),\cdots$ are co-primes.

Divisibility Test of Numbers

- **Divisibility By 2:** A number is divisible by 2, if its unit's digit is any of $0,2,4,6,8$. For e.g., 934 is divisible by 2, while 935 is not.
- **Divisibility By 3:** A number is divisible by 3, if the sum of its digits is divisible by 3. For e.g., 1482 is divisible by 3, since sum of its digits $=(1+4+8+2)=15$, which is divisible by 3; but, 1484 is not divisible by 3, since sum of its digits $=(1+4+8+4)=17$, which is not divisible by 3.
- **Divisibility By 4:** A number is divisible by 4, if the number formed by the last two digits is divisible by 4. For e.g., 648 is divisible by 4, since the number formed by the last two digits is 48, which is divisible by 4; but 282 is not divisible by 4, as the number formed by the last two digits is 82, which is not divisible by 4.
- **Divisibility By 5:** A number is divisible by 5, if its unit's digit is either 0 or 5. Thus, 820 and 345 are divisible by 5, while 934 and 946 are not.
- **Divisibility By 6:** A number is divisible by 6, if it is divisible by both 2 and 3. For e.g., the number 246 is clearly divisible by both 2 and 3.
- **Divisibility By 8:** A number is divisible by 8, if the number formed by the last three digits of the given number is divisible by 8. For e.g., 3480 is divisible by 8, since the number formed by last three digits is 480, which is divisible by 8; but 3418 is not divisible by 8, since the number formed by last three digits is 418, which is not divisible by 8.
- **Divisibility By 9**: A number is divisible by 9, if the sum of its digits is divisible by 9. For e.g., 432 is divisible by 9, since sum of digits $=(4+3+2)=9$, which is divisible by 9.
- **Divisibility By 10:** A number is divisible by 10, if it ends with 0. For e.g., 410, 780 are divisible by 10, while 375 is not.
- **Divisibility By 11:** A number is divisible by 11, if the difference of the sum of its digits at odd places and the sum of its digits at even places is either 0 or a number divisible by 11. For e.g., 12716 is divisible by 11, since: (sum of digits at odd places) – (sum of digits at even places) $=(1+7+6)-(2+1)=11$, which is divisible by 11.
- **Divisibility By 12:** A number is divisible by 12, if it is divisible by both 4 and 3.
- **Divisibility By 14**: A number is divisible by 14, if it is divisible by 2 as well as 7.
- **Divisibility By 15**: A number is divisible by 15, if it is divisible by both 3 and 5.
- If a number is divisible by p as well as q, where p and q are co-primes, then the given number is divisible by pq.
- If p and q are not co-primes, then the given number need not be divisible by pq, even when it is divisible by both p and q. For e.g. 36 is divisible by both 4 and 6, but it is not divisible by $4\times 6=24$, since 4 and 6 are not co-primes.

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- $a^n/(a+1)$ leaves a remainder of 'a if n is odd' and '1 if n is even'.
- $(a+1)^n/a$ will always leaves a remainder of 1.

Example [GA-2012 (2 marks)]: If a prime number on division by 4 gives a remainder of 1, then that number can be expressed as
(a) sum of squares of two natural numbers (b) sum of square roots of two natural numbers
(c) sum of cubes of two natural numbers (d) sum of cube roots of two natural numbers
Solution (a): We know that an odd prime number p is expressed as the sum of two squares $p = x^2 + y^2$, exactly if p leaves a remainder of 1 when it is divided by 4. So option (a) is correct as any number multiplied by 4 given an even number and after adding 1 it becomes an odd number.

Example [GA-2013 (1 mark)]: A number is as much greater than 75 as it is smaller than 117. The number is:
(a) 91 (b) 93 (c) 89 (d) 96
Solution (d): Let x be a number; as per the data given, we have $x - 75 = 117 - x \Rightarrow x = 96$.

Number System Conversion: When we write decimal (base 10) numbers, we use a positional notation system. Each digit is multiplied by an appropriate power of 10 depending on its position in the number. For e.g., $843 = 8\times10^2 + 4\times10^1 + 3\times10^0$. For whole numbers, the rightmost digit position is the one's position ($10^0 = 1$). The numeral in that position indicates how many ones are present in the number. The next position to the left is ten's, then hundred's, thousand's, and so on. Each digit position has a weight that is ten times the weight of the position to its right.

In the decimal number system, there are ten possible values that can appear in each digit position, and so there are ten numerals required to represent the quantity in each digit position. The decimal numerals are the familiar zero through nine ($0,1,2,3,4,5,6,7,8,9$). In a positional notation system, the number base is called the radix. Thus, the base ten system, that we normally use has a radix of 10. The term radix and base can be used interchangeably. When writing numbers in a radix other than ten, or where the radix isn't clear from the context, it is customary to specify the radix using a subscript. Thus, in a case where the radix isn't understood, decimal numbers would be written like this: 126_{10}, 47_{10}, etc. Generally, the radix will be understood from the context and radix specification is left off.

Converting a decimal number into other base system: For converting a decimal number into other base system the following steps should be followed:
Step 1: Divide the decimal number to be converted by the value of the new base.
Step 2: Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.
Step 3: Divide the quotient of the previous divide by the new base.
Step 4: Record the remainder from Step 3 as the next digit (to the left) of the new base number.
Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3. The last remainder thus obtained will be the most significant digit of the new base number.

- **Decimal to Binary to Decimal System:** The binary number system is also a positional notation numbering system, but in this case, the base is not ten, but is instead two. Each digit position in a binary number represents a power of two. So, when we write a binary number, each binary digit is multiplied by an appropriate power of 2 based on the position in the number. For e.g., we convert the decimal number 29_{10} into binary number system and then by using the result, we convert it to decimal number system as:

Step	Operation	Result	Remainder
1	$29/2$	14	1

Now we convert the binary number system 11101_2 into decimal number system:

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2	$14/2$	7	0
3	$7/2$	3	1
4	$3/2$	1	1
5	$1/2$	0	1

So the decimal number 29_{10} into binary number system is 11101_2

1	1	1	0	1	
4^{th}	3^{rd}	2^{nd}	1^{st}	0^{th}	Position
↓	↓	↓	↓	↓	
1×2^4	1×2^3	1×2^2	0×2^1	1×2^0	

Summing the numbers in the last row, we get $1\times2^4+1\times2^3+1\times2^2+0\times2^1+1\times2^0=29_{10}$

- **Decimal to Octal to Decimal System:** The octal number system is also a positional notation numbering system, but in this case, the base is eight. Each digit position in a binary number represents a power of 8. So, when we write an octal number, each octal digit is multiplied by an appropriate power of 8 based on the position in the number.

- **Decimal to Hexadecimal to Decimal System:** In addition to binary, another number base that is commonly used in digital systems is base 16. This number system is called hexadecimal, and each digit position represents a power of 16. For any number base greater than ten, a problem occurs because there are more than ten symbols needed to represent the numerals for that number base. It is customary in these cases to use the ten decimal numerals followed by the letters of the alphabet beginning with A to provide the needed numerals. Since the hexadecimal system is base 16, there are sixteen numerals required. The following are the hexadecimal numerals: $0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F$.

  For e.g., we convert the decimal number 317_{10} into hexadecimal number system and then by using the result, we convert it to decimal number system as:

Step	Operation	Result	Remainder
1	$317/16$	19	$13=D$
2	$19/16$	1	3
3	$1/16$	0	1

So the decimal number 317_{10} into binary number system is $13D_{16}$.

Now we convert the hexadecimal number system $13D_{16}$ into decimal number system:

1	3	D	
2^{nd}	1^{st}	0^{th}	Position
↓	↓	↓	
1×16^2	3×16^1	$D(=13)\times16^0$	

Summing the numbers in the last row, we get $1\times16^2+3\times16^1+13\times16^0=317_{10}$

Example [GA-2010 (2 marks)]: A positive integer m in base 10 when represented in base 2 has the representation p and in base 3 has the representation q. We get $p-q=990$ where the subtraction is done in base 10. Which of the following is necessarily true:

(a) $m\geq14$ (b) $9\leq m\leq13$ (c) $6\leq m\leq8$ (d) $m<6$

Solution (b): If $m=8_{10}$, then $p=1000_2$ and $q=22_3$. So $p-q=1000-22=978<990$ (note that the subtraction is done in base 10); thus $m\not\leq8$, so options (c) and (d) are not correct. Now for $m=14_{10}$, then $p=1110_2$ and $q=112_3$. So $p-q=1110-112=998>990$; thus $m\not\geq14$ and so option (a) is not correct. So we are left with option (b).

Example [GA-2010 (2 marks)]: If $137+276=435$ how much is $731+672$?

(a) 534 (b) 1403 (c) 1623 (d) 1513

Solution (c): We can observe that the given sum is not is base 10. Let the sum is done at base n, so converting all the numbers to base 10: $(137)_n=(1\times n^2+3\times n^1+7\times n^0)_{10}$; $(276)_n=(2\times n^2+7\times n^1+6\times n^0)_{10}$; $(435)_n=(4\times n^2+3\times n^1+5\times n^0)_{10}$. Thus we have

$(1\times n^2+3\times n^1+7\times n^0)_{10}+(2\times n^2+7\times n^1+6\times n^0)_{10}=(4\times n^2+3\times n^1+5\times n^0)_{10}$

$\Rightarrow n^2+3n+7+2n^2+7n+6=4n^2+3n+5\Rightarrow n^2-7n-8=0\Rightarrow n=-1,8\Rightarrow n=8$, as n must $+ve$.

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Thus $(731)_8 = (7\times8^2 + 3\times8^1 + 1\times8^0)_{10} = (473)_{10}$; $(672)_8 = (6\times8^2 + 7\times8^1 + 2\times8^0)_{10} = (442)_{10}$. So we get $(473)_{10} + (442)_{10} = (915)_{10}$. Now we have to convert $(915)_{10}$ to base 8, which is shown in the table. Thus $(915)_{10} = (1623)_8$.

Step	Operation	Result	Remainder
1	915/8	114	3
2	114/8	14	2
3	14/8	1	6
4	1/8	0	1

Example [GA-2014 (2 marks)]: Consider the equation: $(7526)_8 - (Y)_8 = (4364)_8$, where $(X)_N$ stands for X to the base N. Find Y.

(a) 1634 (b) 1737 (c) 3142 (d) 3162

Solution (c): Converting the numbers to base 10 we have:

7	5	2	6
3^{rd}	2^{nd}	1^{st}	0^{th}
↓	↓	↓	↓
7×8^3	5×8^2	2×8^1	6×8^0

and

4	3	6	4
3^{rd}	2^{nd}	1^{st}	0^{th}
↓	↓	↓	↓
4×8^3	3×8^2	6×8^1	4×8^0

$\Rightarrow 7\times8^3 + 5\times8^2 + 2\times8^1 + 6\times8^0 = 3926 \Rightarrow (7526)_8 = (3926)_{10}$

$\Rightarrow 4\times8^3 + 3\times8^2 + 6\times8^1 + 4\times8^0 = 2292 \Rightarrow (4364)_8 = (2292)_{10}$

So $(Y)_{10} = (3926)_{10} - (2292)_{10} = (1634)_{10}$.

Now we have to convert the value of Y from base 10 to base 8. The step are shown in the table. Thus $(1634)_{10} = (3142)_8$, which is the value of Y in base 8.

Step	Operation	Result	Remainder
1	1634/8	204	2
2	204/8	25	4
3	25/8	3	1
4	3/8	0	3

Unit Digit: The unit digit of a $+ve$ integer is the digit in the one's position, i.e. it is the last digit.

- When it is asked to find the unit digit in product of two different numbers (without powers) we have to multiply the last digit of every number, which gives the unit digit which is same asked in given question.
- When it is asked to find the unit digit of a numbers (with powers) we have to first figure out the pattern for unit digit and solve the problem easily.
- When it is asked to find the unit digit in addition/subtraction of two numbers, we have to find the unit digit of numbers and after addition/subtraction of the unit digit of numbers we get the required unit digit.

Example: Find the unit digit in the product of numbers $344\times988\times327$.

Solution: The unit digit in the given product of numbers is simply the unit digit in the product of last digits in every number, i.e. required unit digit is unit digit in $4\times8\times7 = 224$, so the unit digit is 4.

Example: Find the unit digit in 13^{35}.

Solution: The last digit of 13 is 3. So unit digit of 13^1 is 3; unit digit in 13^2 is same as the unit digit in 3^2, i.e. 9. Similarly, unit digit in 13^3 is 7; unit digit in 13^4 is 1; 13^5 is 3; unit digit in 13^6 is 9; unit digit in 13^7 is 7; unit digit in 13^8 is 1; and so on. So as we increase the power of 13, we get the pattern of unit digit as: 3, 9, 7, 1, 3, 9, 7, 1, etc., i.e. the pattern repeats itself after every 4 powers. So we can say that whenever n is a multiple of 4, the unit digit in 13^n is 1. Now as $13^{35} = 13^{32}\times13^3$, so unit digit in 13^{35} is unit digit in the product of 'unit digit of 13^{32}' and 'unit digit of 13^3'. So the required unit digit is $1\times7 = 7$.

Example: Find the unit digit in $13^{35} - 344\times988\times327$.

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Solution: From the result of previous two examples the required unit digit is $4-7=7$. Note that we have taken a carry from tens place so 4 becomes 14. In case of subtraction it should be noted that the first digit must be greater than the second digit. For e.g. in the subtraction of $342-354$ if we find the unit digit by subtracting simply the units digits of number then we have $2-4=8$ (we have taken a carry from tens place so 2 becomes 12); but this is not correct because 342 is less than 354; so for find the correct unit digit, we must write firstly $354-342$ and so the required unit digit is $4-2=2$.

Exercise: 5.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	If n is a whole number greater than 1, then $n^2(n^2-1)$ is always divisible by (a) 12 (b) 24 (c) 48 (d) 60
2.	19^5+21^5 is divisible by (a) Only 10 (b) Only 20 (c) Both 10 and 20 (d) Neither 10 nor 20
3.	If b is the largest square divisor of c and a^2 divides c, then which one of the following is correct (where a, b and c are integers)? (a) b divides a (b) a does not divides b (c) a divides b (d) a & b are co-primes
4.	If k is a positive integer, then every square integer is of the form (a) Only $4k$ (b) $4k$ or $4k+3$ (c) $4k+1$ or $4k+3$ (d) $4k$ or $4k+1$
5.	Every prime number of the form $3k+1$ can be represented in the form $6m+1$ (where k and m are integers), when (a) k is odd (b) k is even (c) k can be both odd and even (d) No such form is possible
6.	If x is a positive integer and y is negative odd integer, then x^y is (a) an odd integer (b) an even integer (c) a rational number (d) none of these
7.	If m and n are natural numbers, then $\sqrt[m]{n}$ is (a) always irrational (b) irrational unless n is the m^{th} power of an integer (c) irrational if m, n are co-primes (d) irrational unless m is the n^{th} power of an integer
8.	The smallest positive prime (say p) such that 2^p-1 is not a prime is (a) 5 (b) 11 (c) 17 (d) 29
9.	Which one of the following has least number of divisors? (a) 88 (b) 91 (c) 96 (d) 99
10.	Which one of the following is neither prime number nor composite number? (a) 1 (b) 2 (c) 3 (d) None of these
11.	The pair of numbers which are relatively prime to each other is (a) 68, 85 (b) 65, 91 (c) 92, 85 (d) 102, 153
12.	How many rational numbers are there between 1 and 1000? (a) 998 (b) 999 (c) 1000 (d) None of these
13.	How many numbers between –11 and 11 are multiples of 2 or 3? _____
14.	If a positive integer leaves remainder 28 when divided by 143, then what is the remainder obtained on dividing the same number by 13? _____
15.	Which one of the following is prime number? (a) 161 (b) 171 (c) 173 (d) 221
16.	If n is a natural number then $\sqrt{n}$ is (a) always a natural number (b) always a rational number (c) always an irrational number (d) either a natural number or an irrational number

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17. When a positive integer n is divided by 5, the remainder is 2. What is the remainder when the number $3n$ is divided by 5? _____

18. Consider the following numbers (i) 247; (ii) 203. Which of the given numbers is/are prime number?
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

19. If $d(n)$ is defined as the number of positive divisors of n. What is the value of $d[d\{d(12)\}]$?
_____

20. The product of rational number and irrational number is _____ number.
(a) a natural (b) an irrational (c) a composite (d) a rational

21. What is the value of x for which $x, x+1, x+3$ are all prime numbers?
(a) 0 (b) 1 (c) 2 (d) 101

22. A three digit number is divisible by 11 and has its digit in the unit's place equal to 1. The number is 297 more than the number obtained by reversing the digits. What is the number?
(a) 121 (b) 231 (c) 561 (d) 451

23. The remainder on dividing given integers a and b by 7 are, respectively, 5 and 4. What is the remainder when ab is divided by 7? _____

24. What least value must be given to x, so that the number $84705x2$ is divisible by 9? _____

25. If p is an integer, then every square integer is of the form
(a) $2p$ or $(4p-1)$ (b) $4p$ or $(4p-1)$ (c) $3p$ or $3p+1$ (d) $4p$ or $4p+1$

26. When a natural number n is divided by 4, the remainder is 3. What is the remainder when $2n$ is divided by 4? _____

27. If we divide a positive integer by another positive integer, what is the resulting number?
(a) It is always a natural number (b) It is always an integer
(c) It is a rational number (d) It is an irrational number

28. What is the total number of three digit numbers with unit digit 7 and divisible by 11? _____

29. What is the sum of positive integers less than 100 which leaves a remainder 1when divided by 3 and leaves a remainder 2 when divided by 4? _____

30. What least value must be given to x, so that the number $8798546x5$ is divisible by 11? _____

31. Which one of the following statement is always correct?
(a) The square of a prime number is prime
(b) The sum of two square numbers is a square number
(c) The number of digits in a square number is even
(d) The product of two square numbers is a square number

32. A number when divided by 987, gives a remainder 59. When the same number is divided by 21, what is the remainder? _____

33. Which of the following numbers is a prime number?
(a) 667 (b) 861 (c) 481 (d) 331

34. On dividing 4996 by a certain number, the quotient is 62 and the remainder is 36. What is the divisor? _____

35. A three digit number has digits x, y, z (from left to right) with $x > z$. If the digits are reversed and the number thus formed is subtracted from the original number, the unit's digit in the resulting number is 4. What are the other two digits of the resulting number from left to right?
(a) 5, 9 (b) 9, 5 (c) 5, 4 (d) 4, 5

36. If the numbers x, $x+2$ and $x+6$ are all prime, then what can be the value of $3x+9$?
(a) only 18 (b) only 42 (c) only 60 (d) both (b) and (c)

37. The sum of two irrational numbers
(a) is always a natural of irrational (b) may be rational or irrational
(c) is always a rational number (d) is always an irrational number

38. In a division operation, the divisor is 5 times the quotient and twice the remainder. If the remainder is 15, then what is the dividend? _____

39. Which one of the following numbers is a composite numbers?
(a) 589 (b) 571 (c) 569 (d) 563

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40. What least number should be subtracted from 26492518, so that the resulting number is divisible by 3 but not by 9? _____

41. A ten digit number is divisible by 4 as well as by 5. What could be the possible digit at the ten's place in the given number?
(a) 0, 1, 2, 4 or 6 (b) 1, 2, 4, 6 or 8 (c) 2, 3, 4, 6 or 8 (d) 0, 2, 4, 6 or 8

42. By adding x to 1254934, the resulting number becomes divisible by 11, while adding y to 1254934 makes the resulting number divisible by 3. Which one of the following is the set of values of x and y?
(a) $x=1, y=1$ (b) $x=1, y=-1$ (c) $x=-1, y=1$ (d) $x=-1, y=-1$

43. What is the last digit in $7^{402}+3^{402}$? _____

44. If n is a positive integer, then what is the digit in the unit place of $3^{2n+1}+2^{2n+1}$? _____

45. What is the last digit in 3^{4798}? _____

46. What is the last digit in 2457^{754}? _____

47. What is the last digit in $354\times 998\times 327\times 763$? _____

48. What is the unit digit in the product $13^{125}\times 26^{123}\times 17^{43}$? _____

49. What is the unit digit in $27^{43}-13^{78}$? _____

50. What is the unit digit in 2437^{1506}? _____

51. What is the unit digit in $4^{3463}\times 5^{765}\times 71^{453}$? _____

52. Consider the following statements and decide which statement is/are correct?
(i) No integer of the form $4k+3$, where k an integer, can be expressed as the sum of two squares.
(ii) Square of an odd integer can be expressed in the form of $8k+1$, where k an integer
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

53. Consider the following statements and decide which statement is/are correct?
(i) To obtain prime number less than 121, we have to reject all the multiples of 2, 3, 5 and 7.
(ii) Every composite number less than 121 is divisible by a prime number less than 11.
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

54. Consider the following statements and decide which statement is/are correct?
(i) There is a finite number of rational numbers between any two rational numbers.
(ii) There is an infinite number of rational numbers between any two rational numbers.
(iii) There is a finite number of irrational numbers between any two rational numbers.
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

55. Consider the following statements and decide which statement is/are correct?
(i) Every integer is a rational number (ii) Every rational number is a real number
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

56. Consider the following statements and decide which statement is/are correct?
(i) If n is a prime number greater than 5, then n^4-1 is divisible by 2400.
(ii) Every square number is of the form $5n$ or $(5n-1)$ or $(5n+1)$, where n is a whole number.
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

57. Consider the following statements and decide which statement is/are correct?
(i) Every composite number is a natural number
(ii) Every whole number is a natural number
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

58. Consider the following statements and decide which statement is/are correct?
(i) The product of any three consecutive integers is divisible by 6
(ii) Any integer can be expressed in one of the three forms $3k, (3k+1), (3k+2)$, where k is an integer
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

59. Consider the following statements and decide which statement is/are correct?

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(i) If p is a prime such that $p+2$ is also a prime, then $p(p+2)+1$ is a perfect square

(ii) If p is a prime such that $p+2$ is also a prime, then 12 is a divisor of $p+(p+2)$ if $p>3$

(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

60. If a number '*pqrst*' is divisible by 11, then

(a) $t-s+r-q+p$ is divisible by 11 (b) $t-s+r-q+p=0$

(c) Option (a) or (b) (d) Option (a) and (b)

61. If a number '*pqrst*' is divisible by 9 then

(a) $p+q+r+s+t$ is divisible by 9 (b) $p-q+r-s+t$ is divisible by 9

(c) Option (a) or (b) (d) Option (a) and (b)

62. Assertion (A): Zero is a whole number

Reason (R): Every integer is a whole number

(a) A and R are correct but R is correct explanation of A

(b) A and R are correct but R is not correct explanation of A

(c) A is correct but R is wrong

(d) A is wrong but R is correct

63. a^n+b^n is divisible by $a-b$

(a) for all integral values of n (b) when n is an even integer

(c) when n is an odd integer (d) for no integral value of n

64. The difference between the place value and the face value of 9 in the numeral 264956 is _____

65. The product of place value and two times the face value of 5 in the numeral 2857 is _____

66. The difference between the place values of two 5s in the numeral 2855 is _____

67. On converting the number 23 (which is in decimal system) into a number at base 3, we get _____

68. On converting the number 43 (which is at base 5) into a decimal system, we get _____

69. On converting the number 52 (which is at base 8) into a decimal system, we get _____

70. On converting the number 110 (which is at base 6) into a decimal system, we get _____

71. On converting the number 487 (which is at base 10) into a hexadecimal system, we get _____

72. On converting the number 1107 (which is in octal system) into a decimal system, we get _____

73. On converting the number 572 (which is decimal system) to the base 16, we get

(a) 23C (b) 32C (c) 23D (d) 32D

74. On converting the number 1A7E (which is at the base 16) into a decimal system, we get _____

75. On converting the number 37D (which is at the base 16) to the base 9, we get _____

76. To what base does the sum $60+74=154$ is calculated?

77. If $323+223=550$, then $151+111=?$

78. If $12\times 20=1010$, then $20\times 21=?$

79. $201-122=35$, then $210-154=?$

80. $31\div 17=2$, then $20\div 10=?$

81. If $(6734)_9-(Y)_9=(4321)_9$, where $(X)_N$ stands for X to the base N. Y is ____.

82. If $(1554)_N+(206)_N=(2063)_N$, where $(X)_N$ stands for X to the base N. N is ____.

83. If $(24)_N\times(13)_N=(400)_N$, where $(X)_N$ stands for X to the base N. N is ____.

84. If $(12)_N+(Y)_N=(31)_N$ and $(34)_N+(Y)_N=(103)_N$, then values of Y and N are

(a) $Y=14$, $N=5$ (b) $Y=5$, $N=14$ (c) $Y=12$, $N=8$ (d) $Y=8$, $N=12$

85. If $(435)_N-(Y)_N=(137)_N$ and $(1227)_N-(Y)_N=(731)_N$, then values of Y and N are

(a) $Y=672$, $N=8$ (b) $Y=276$, $N=9$ (c) $Y=276$, $N=8$ (d) $Y=672$, $N=9$

86. Convert $(4372)_8$ to hexadecimal number.

(a) $(8EA)_{16}$ (b) $(8FA)_{16}$ (c) $(ZEB)_{16}$ (d) $(8AA)_{16}$

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87. In hexadecimal system, the difference between largest four digit number and smallest non-negative number is
(a) 9999 (b) AAAA (c) FFFE (d) FFFF

88. On dividing $(10001111)_2$ by $(1101)_2$, we get
(a) $(1101)_2$ (b) $(1011)_2$ (c) $(1001)_2$ (d) $(1110)_2$

89. A positive integer m in base 10 when represented in base 2 has the representation p and in base 3 has the representation q. We get $p+q=132$ where the addition is done in base 10. Which of the following is necessarily true:
(a) $m \geq 14$ (b) $9 \leq m \leq 13$ (c) $6 \leq m \leq 8$ (d) $m < 6$

90. A positive integer m in base 10 when represented in base 2 has the representation p and in base 5 has the representation q. We get $p \times q = 1$ where the multiplication is done in base 10. Which of the following is necessarily true:
(a) $m \geq 14$ (b) $10 \leq m \leq 13$ (c) $5 \leq m \leq 9$ (d) $m < 5$

91. Two times a two digit number is 9 times the number obtained by reversing the digits and sum of the digits is 9. The sum of digits of the number is _____

92. The students present in a ground are asked to stand in rows. If there were 4 students extra in a row there would be 4 less rows. However, if 2 students were less in a row, there would be 4 more rows. The number of students present in the ground is _____

93. The sum of two numbers, one of which is $1/3^{rd}$ of the other is 36. The smallest number is _____

94. If all the numbers which are divisible by 5 and also those which have 5 as one of the digits are eliminated from the numbers 1 to 60, how many numbers would remain? _____

95. The sum of the place values of 3 in the number 503535 is _____

96. A number when divided by 765 leaves a remainder 42. What will be the remainder if the number is divided by 17? _____

97. The number $6n^2+6n$ for natural number n is always divisible by
(a) 6 (b) 18 (c) 12 (d) 6 and 12

98. What is the value of x and y, respectively if $x39048458y$ is divisible by 8 and 11, where x and y are single digit integers?
(a) 7, 8 (b) 8, 6 (c) 6, 4 (d) 5, 4

99. Which of the following integers is the square of every integer n?
(a) n^2+1 (b) n^2+n (c) n^2+2n (d) n^2+2n+1

100. If x and y are negative, then which of the following statements is/are true?
(i) $x+y$ is positive (ii) xy is positive (iii) $x-y$ is positive
(a) Only (i) (b) Only (ii) (c) Only (iii) (d) (i) and (iii) only

101. A student was asked to divide a number by 6 and add 12 to the quotient. But by mistake, he first added 12 to the number and then divided it by 6, getting 112 as the answer. The correct answer should have been _____

102. Pankaj dealt some cards to Mohan and himself from a pack of playing cards and laid the rest aside. Pankaj then said to Mohan, "If you give me a certain number of cards, I will have 4 times as many cards as you have. If I give you the same number of cards, I will have thrice as many cards as you have." How many cards did Pankaj have? _____

103. There are four prime numbers written in ascending order. The product of the first three is 385 and that of the last three is 1001. What is the second prime number?
(a) 5 (b) 7 (c) 11 (d) 17

104. The remainder when 5^{84} is divided by 124 is _____

105. A positive integer, which when added to 500, gives a sum which is greater than when it is multiplied by 500. This positive integer is
(a) 1 (b) 3 (c) 5 (d) 7

106. What is the remainder when $(8^{84}+6)$ is divided by 7. _____

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107.	If the sum of the digits of an even number is divisible by 9, then that number is always divisible by (a) 27 (b) 18 (c) 24 (d) 12
108.	The unit digit in the product of $7^{35}\times 3^{71}\times 11^{55}$ is _____
109.	Find the smallest number N such that its decimal representation has 6 as the last digit. If the last digit 6 is erased and placed in front of the remaining digits, the resulting number is four times as great as the original number N. _____
110.	A class of 100 students. 24 of them are girls and 32 are not. Which base am I using? _____
111.	Consider a number 235, where last digit is the sum of first two digits i.e. $2+3=5$. How many such 3-digit numbers are there? _____

5.2 HCF, LCM and Averages

HCF (Highest Common Divisor) or GCD (Greatest Common Divisor) of numbers: Let $x_1, x_2, x_3, \cdots, x_n$ are the numbers which all are exactly divisible by the same number y; then y is called the common divisor of $x_1, x_2, x_3, \cdots, x_n$. The highest of all the common divisors of $x_1, x_2, x_3, \cdots, x_n$ is called HCF and denoted as $\text{HCF}(x_1, x_2, x_3, \cdots, x_n)$.

- **Rule for finding the HCF: Step 1:** Find all prime factors of number. **Step 2:** Write the numbers as a multiple of prime numbers. **Step 3:** Find which factors are repeating in all the numbers and then multiply them to get HCF. For e.g. for finding the HCF of 150, 210, 375, we have

$$\left.\begin{aligned} 150 &= \underline{5}\times 5\times \underline{3}\times 2\\ 210 &= \underline{5}\times 7\times \underline{3}\times 2\\ 375 &= \underline{5}\times 5\times 5\times \underline{3}\end{aligned}\right\} \Rightarrow \begin{array}{l}\text{we have 5 and 3 common in all the given numbers}\\ \text{So, HCF} = 5\times 3 = 15\end{array}.$$

LCM (Least Common Multiple) of numbers: Let $x_1, x_2, x_3, \cdots, x_n$ are the distinct numbers; the smallest natural number y, that is exactly divisible by all the $x_1, x_2, x_3, \cdots, x_n$ numbers, is called the LCM of $x_1, x_2, x_3, \cdots, x_n$ and denoted as $\text{LCM}(x_1, x_2, x_3, \cdots, x_n)$.

- **Rule for finding LCM: Step 1:** Find all the prime factors of given numbers. **Step 2:** Raise each of the prime listed in Step 1 to the highest of the powers in which it appears in the standard forms of the given numbers. **Step 3:** Multiply all the prime factors (with their powers) having highest power. For e.g. for finding the LCM of 150, 210, 375, we have

$150 = 5\times 5\times 3\times 2 = 7^0\times 5^2\times 3^1\times 2^1$ so among the given numbers,

$210 = 5\times 7\times 3\times 2 = 7^1\times 5^1\times 3^1\times 2^1 \Rightarrow$ we have $7^1, 5^3, 3^1$ and 2^1 having the highest power.

$375 = 5\times 5\times 5\times 3 = 7^0\times 5^3\times 3^1\times 2^0$ So, $\text{LCM} = 7^1\times 5^3\times 3^1\times 2^1 = 5250$

- **Some important points regarding HCF and LCM of numbers:**
  - For two positive a and b, $\text{HCF}(a,b) = \text{HCF}\{a,(a+b)\} = \text{HCF}\{a,(a-b)\} = \text{HCF}\{(a+b),(a-b)\}$
  - For two positive integers a and b, we have $a\times b = \text{HCF}(a,b)\times\text{LCM}(a,b)$
  - For three positive integers a, b and c, we have $a\times b\times c = \{\text{HCF}(a,b,c)\}^2\times\text{LCM}(a,b,c)$
  - For three positive integers a, b and c, we have $a\times b\times c = \{\text{LCM}(a,b,c)\times\text{HCF}(a,b)\times\text{HCF}(b,c)\times\text{HCF}(c,a)\}/\{\text{HCF}(a,b,c)\}$
  - HCF(two or more numbers) = {HCF of Numerators}/{LCM of Denominators}
  - LCM(two or more numbers) = {LCM of Numerators}/{HCF of Denominators}

HCF and LCM of Polynomials: The relation between HCF and LCM of two polynomials is the product of the two polynomials which are their HCF and LCM. If $p(x)$ and $q(x)$ are two polynomials, then $p(x)\cdot q(x) = [\text{HCF}\{p(x),q(x)\}]\times[\text{LCM}\{p(x),q(x)\}]$.

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- A polynomial $h(x)$ is called HCF of two polynomials $p(x)$ and $q(x)$, if $h(x)$ is a common factor of $p(x)$ and $q(x)$.
- For finding the LCM of $p(x)$ and $q(x)$, we apply the same procedure as was applied for the numbers.

Example: Find the HCF and LCM of the expression $p(x)=x^2-12x+35$ and $q(x)=x^3-15x^2+63x-49$.

Solution: As $x^2-12x+35=(x-7)(x-5)$ and $x^3-15x^2+63x-49=(x-7)^2(x-1)$. So $\text{HCF}\{p(x),q(x)\}=(x-7)$ and $\text{LCM}\{p(x),q(x)\}=(x-7)^2(x-5)(x-1)$.

Average: The average of a number is a measure of the central tendency of a set of numbers. In other words, it is an estimate of where the centre point of a set of numbers lies. The average is also known as arithmetic mean (AM) of a set of numbers. If $x_1,x_2,x_3,\cdots,x_n$ are n numbers, then average of these n numbers is denoted by $\overline{x}=\{x_1+x_2+x_3+\cdots+x_n\}/n$. In other words $\text{Average of observations}=\{\text{total sum of observations}\}/\{\text{total number of observations}\}$.

- **Weighted Average:** When we have two or more groups whose individual averages are known, then to find the combined average of all the elements of all the groups we use weighted average. Thus, if we have k groups with averages $A_1,A_2,A_3,\cdots,A_k$ and having $n_1,n_2,n_3,\cdots,n_k$ elements then the weighted average is denoted by $\overline{x}_w=\dfrac{n_1A_1+n_2A_2+n_3A_3+\cdots+n_kA_k}{n_1+n_2+n_3+\cdots+n_k}$.

Example [GA-2014 (1 mark)]: The table below has question-wise data on the performance of students in an examination. The marks for each question are also listed. There is no negative or partial marking in the examination. What is the average of the marks obtained by the class in the examination?

Q.No.	1	2	3
Marks	2	3	2
Answered Correctly	21	15	23
Answered Wrongly	17	27	18
Not attempted	6	2	3

(a) 1.34 (b) 1.74 (c) 3.02 (d) 3.91

Solution (c): The required average of the marks obtained by the class in the examination will be $\dfrac{\text{total marks secured by student}}{\text{total number of student}}=\dfrac{2\times21+3\times15+2\times23}{21+17+6}=3.02$.

Example [GA-2015 (2 marks)]: The number of students in a class who have answered correctly, wrongly, or not attempted each question in an exam, are listed in the table below. The marks for each question are also listed. There is no negative or partial marking. What is the average of the marks obtained by the class in the examination?

Q. No.	1	2	3	4	5
Marks	2	3	1	2	5
Answered Correctly	21	15	11	23	31
Answered wrongly	17	27	29	18	12
Not attempted	6	2	4	3	1

(a) 2.290 (b) 2.970 (c) 6.795 (d) 8.795

Solution (c): The required average of the marks obtained by the class in the examination will be $\dfrac{\text{total marks secured by student}}{\text{total number of student}}=\dfrac{2\times21+3\times15+1\times11+2\times23+5\times31}{21+17+6}=7.975$.

Exercise 5.2

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. The total number of integral solutions of the equations $\text{HCF}(a,b)=5$ and $a+b=65$ is

(a) exactly one (b) infinitely many (c) less than 65 (d) less than 13

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2. If a and b are positive integers, then $\text{HCF}\left(a/\{\text{HCF}(a,b)\}, b/\{\text{HCF}(a,b)\}\right)$ is
(a) a (b) b (c) 1 (d) $\text{HCF}(a,b)$

3. For any integers 'x' and 'y' with $\text{HCF}(x,y)=1$, what is $\text{HCF}(x+y, x-y)$?
(a) 1 (b) 2 (c) 1 or 2 (d) None of these

4. For any integers 'x', what is $\text{HCF}(22x+7, 33x+10)$?
(a) 1 (b) 2 (c) 1 or 2 (d) None of these

5. In a fire range, 4 shooters are firing at their respective targets. The first, the second, the third and the fourth shooter hit the target once in every 5s, 6s, 7s, and 8s, respectively. If all of them hit their target at 10:00 AM, when will they hit their target together again?
(a) 10:05 AM (b) 10:10 AM (c) 10:12 AM (d) 10:14 AM

6. If for integers x, y and z, if $\text{HCF}(x,y)=1$ and $\text{HCF}(x,z)=1$ then which of the following is correct:
(a) $\text{HCF}(x,yz)=1$ (b) $\text{HCF}(x,yz)=x$ (c) $\text{HCF}(x,yz)=y$ (d) None of these

7. If $\text{HCF}(x,y)=98$ and $\text{LCM}(x,y)=2352$, then value of $x+y$ can be
(a) 1372 (b) 1398 (c) 1426 (d) 1484

8. If $\text{HCF}(x,y)=33$, $\text{LCM}(x,y)=2376$ and $x=297$ then value y is _____

9. The product of HCF and LCM of 18 and 12 is _____

10. Three planets revolve round the Sun once in 300, 350 and 400 days, respectively, in their own orbits. When do they all come relatively to the same position at a certain point of time in their orbit?
(a) after 8400 days (b) after 7400 days (c) after 6days (d) after 5400 days

11. What is the greatest number that divides 850 and 250 and leaves a remainder of 6? _____

12. The HCF and LCM of two numbers are 10 and 180, respectively. What is the difference between the two numbers, if one of the numbers is 20? _____

13. If $\text{HCF}(x,y)=29$ and $x+y=232$ then total number of pairs of (x,y) is _____

14. The product of two numbers is 6016 and their HCF is 2. What is their LCM? _____

15. What is the LCM of $2/3, 7/9, 13/15$?
(a) $182/3$ (b) $192/3$ (c) $182/5$ (d) $192/5$

16. The least number which when divided by 5, 6 and 7 leaves a remainder 3 is _____

17. If $\text{HCF}(144,x,192)=12$ then the number x cannot be
(a) 180 (b) 84 (c) 60 (d) 48

18. $\text{HCF}(3.0, 1.2, 0.06)$ = _____

19. What is the least number of square tiles required to pave the floor of a room which is 999 cm long and 407 cm broad? _____

20. What is the sum of the digits of the least number which when divided by 156 leaves 149 as remainder; when divided by 78 leaves 71 and when divided by 117 leaves 110 as remainder? _____

21. What is the smallest positive integer which when divided by 4, 5, 8 and 9 leaves remainder 2, 3, 6 and 7, respectively? _____

22. Consider those numbers between 400 and 500 such that when each number is divided by 6, 9 and 12, it leaves 4 as remainder in each case. What is the sum of the numbers? _____

23. If the HCF of two positive integers is 12, then their LCM cannot be
(a) 36 (b) 108 (c) 472 (d) 300

24. For any integer n, what is the HCF of integers $m=2n+1$ and $k=9n+4$?
(a) 1 (b) 2 (c) 3 (d) 4

25. For three natural numbers m, n and k, consider the following statements: (i) $\text{HCF}(m,nk)=\text{HCF}(mn,k)$; (ii) $\text{HCF}(mn,nk)=\text{HCF}(m,k)$. Which of the given statements is/are correct?
(a) only (i) (b) only (ii) (c) both (i) and (ii) (d) neither (i) nor (ii)

26. What is the greatest number which divides 333, 481 and 703 so as to leave the same remainder

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	in each case? _____
27.	42 mango trees, 56 apple trees and 84 orange trees have to be planted in rows such that each row contains the same number of trees of one variety only. What is the minimum number of rows in which the above trees may be planted? _____
28.	The LCM of three different numbers is 520. Which of the following cannot be their HCF? (a) 96 (b) 130 (c) 260 (d) 52
29.	Let p, q and r are natural numbers. If $\text{LCM}(p,q,r)=m$ and $\text{HCF}(p,q,r)=n$; consider the following statements: (i) $mn=pqr$ if and only if p, q and r is prime; (ii) $mn=pqr$ if and only if p, q and r are relatively prime in pairs. Which of the given statements is/are correct? (a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)
30.	If $\text{HCF}(m,n)=1$, then $\text{HCF}(m+n,m)$ and $\text{HCF}(m-n,n)$ are _____, respectively, where $m>n$. (a) 2 and 1 (b) 1 and 2 (c) 1 and 1 (d) Data insufficient
31.	LCM of two numbers is 16 times their HCF. The sum of LCM and HCF is 816. If one number is 32, then what is the other number? _____
32.	5 dogs start barking at each other at the intervals of 2, 4, 6, 8 and 10 seconds, respectively. How many times the five dogs do barks together in 20 minutes? _____
33.	A person has four iron bars whose lengths are 24 m, 36 m, 48 m, 84 m, respectively. This person wants to cut pieces of same length from each of the four bars. What is the least number of total pieces if he is to cut without any wastage? _____
34.	Three different containers contain different quantities of a mixture of milk and water, whose measurements are 120 kg, 225 kg and 300 kg. What biggest measure be there to measure all the different quantities exactly? _____
35.	The HCF and LCM of two numbers are 21 and 4641, respectively. If one of the numbers lies between 200 and 300, then the two numbers are (a) 273, 363 (b) 273, 357 (c) 253, 363 (d) 253, 357
36.	The sum of two numbers is 462 and their HCF is 22. What is the maximum number of pairs that satisfy these conditions? _____
37.	A certain type of wooden board is sold only in length of multiples of 25 cm from 2 to 10 m. A carpenter needs a large quantity of this type of board in 1.55 m length. For the minimum waste, the lengths (in cm) to be purchased should be _____
38.	What is the LCM of x^2+2x-8, x^3-4x^2+4x and x^2+4x? (a) $x(x+4)(x-2)^2$ (b) $x(x+4)(x-2)$ (c) $x(x+4)(x+2)^2$ (d) $x(x+4)^2(x-2)$
39.	What is the LCM of (x^3-x^2-2x) and (x^3+x^2) is (a) x^3-x^2-2x (b) x^2+x (c) $x^4-x^3-2x^2$ (d) $x-2$
40.	If $(x-6)$ is the HCF of $(x^2-2x-24)$ and (x^2-kx-6), then what is the value of k? _____
41.	What is the LCM of (a^3b-ab^3), $(a^3b^2-a^2b^3)$ and $ab(a+b)$? (a) $a^2b^2(a^2-b^2)$ (b) $ab(a^2-b^2)$ (c) $a^2b^2+ab^3$ (d) $a^3b^3(a^2-b^2)$
42.	The HCF of two polynomials $p(x)$ and $q(x)$ is $2x(x+2)$ and LCM is $24x(x+2)^2(x-2)$. If $p(x)=8x^3+32x^2+32x$, then what is $q(x)$? (a) $4x^3-16x$ (b) $6x^3-24x$ (c) $12x^3+24x$ (d) $12x^3-24x$
43.	If $f(x)$ and $g(x)$ are two polynomials with integral coefficients which vanish at $x=1/2$, then what is the factor of $\text{HCF}\{f(x),g(x)\}$? (a) $x-1$ (b) $x-2$ (c) $2x-1$ (d) $2x+1$
44.	Consider the following statements and decide which statement is/are correct? (i) The HCF of $x+y$ and $x^{10}-y^{10}$ is $x+y$ (ii) The HCF of $x+y$ and $x^{10}+y^{10}$ is $x+y$

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(iii) The HCF of $x-y$ and $x^{10}+y^{10}$ is $x-y$

(iv) The HCF of $x-y$ and $x^{10}-y^{10}$ is $x-y$

(a) Only (i) and (ii) (b) Only (ii) and (iii) (c) Only (i) and (iv) (d) Only (ii) and (iv)

45. If the HCF of x^3-27 and $x^3+4x^2+12x+k$ is a quadratic polynomial, then what is the value of k ? _____

46. What are the values of c when the HCF of x^3+cx^2-x+2c and x^3+cx-2 over the rationals is a linear polynomial?

(a) ± 1 (b) ± 2 (c) ± 3 (d) ± 4

47. If $(x+2)$ is the HCF of x^2+ax+b and x^2+cx+d, where $a \neq c$ and $b \neq d$, then which of the following is correct?

(a) $a+c=b+d$ (b) $2a+b=2c+d$ (c) $b+2c=2a+d$ (d) $b-2c=2a-d$

48. If $(x+k)$ is the HCF of ax^2+ax+b and x^2+cx+d, then what is the value of k ?

(a) $(b+d)/(a+c)$ (b) $(a+b)/(c+d)$ (c) $(a-b)/(c-d)$ (d) None of these

49. If the HCF of (x^2+x-12) and $(2x^2-kx-9)$ is $(x-k)$, then what is the numeral value of k ? _____

50. What is the HCF of $x^2+bx-x-b$ and $x^2+x(a-1)-a$

(a) $x+b$ (b) $x+a$ (c) $x+1$ (d) $x-1$

51. If the average of A and B is 40, the average of C and D is 30 then, which of the following statement is/are correct?

(i) The average of B and C must be greater than 35

(ii) The average of A and D must be less than 35

(a) Only (i) (b) Only (ii) (c) Either (i) or (ii) (d) Neither (i) nor (ii)

52. The average weight of a class of 15 boys and 10 girls is 38 kg. If the average weight of the boys is 40 kg, then what is the average weight of the girls? _____

53. The mean weight of 150 students in a class is 60 kg. The mean weight of boys is 70 kg and that of girls is 55 kg. What is the number of girls in the class? _____

54. Out of 250 observations, the first 100 observations have mean 5 and the average of the remaining 150 observations is 25. What is the average of the whole group of observations? _____

55. In an examination, 40% of the candidates wrote their answers in Hindi and the others in English. The average marks of the candidates written in Hindi is 75 and the average marks of the candidates written in English is 70. What is the average mark of all the candidates? _____

56. Nine numbers are written in ascending order. The middle number is the average of the nine numbers. The average of the first five larger numbers is 68 and that of five smaller numbers is 44. What is the sum of all nine numbers? _____

57. How much tea at ₹ 9 per kg must be mixed with 100 kg of superior tea at ₹ 13 per kg to give an average price of ₹ 11 per kg? _____

58. Sachin scores 80 runs in his sixth innings and thus increases his average by 5. What is the average after six innings? _____

59. Person A claims the number of chocolates in a bag is greater than 80 but less than 87. Person B claims the number of chocolates in the same bag is greater than 75 but less than 85. On the other hand, person C claims the number of chocolates cannot be greater than 84. If all the estimation is found to be correct, then what is the average of number of chocolates in the bag? _____

60. The average weight of 25 girls in a class is 35 kg and that of 25 boys is 55 kg. Find the average weight (in kg) of all the students in the class. _____

61. The average weight of X, Y and Z is 80 kg. If the average weight of X and Y is 60 kg and that of Y and Z is 70 kg, then the weight of Y (in kg) is _____

62. The sum of three consecutive odd numbers is 50 more than the average of these three numbers. What is the second of these numbers? _____

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63. The average weight of three men A, B and C is 80 kg. Another man D joins the group and the average now becomes 75 kg. If another man E whose weight is 5 kg more than that of D, replaces A then the average weight of B, C, D and E becomes 74 kg. The weight of A is _____

64. The average of 20 numbers is 10. If each number is multiplied by 15, then what will be the new average? _____

65. The average age of 30 students sitting in three rows distributed equally is 10 years. The average age of those in first and second row is 12 and 10 years, respectively. Find the average age (in years) of the students in the last row. _____

66. A batsman's average score for a certain number of innings was 21 runs. In the next three innings, he scored 25, 30, 35 runs, respectively, and the average score increased by 0.75 runs. How many innings did he play in all? _____

67. In a class of 25 students, 8 students can solve 20 problems each per week, 12 other students can solve 25 problems each per week. If the average capacity of the class is 22 problems per week, the average capacity of the remaining students? _____

68. The average of 50 numbers is zero. Of them, at most how many may be greater than zero? _____

69. A car owner buys petrol at ₹ 50, ₹ 55 and ₹ 60 per litre for three consecutive years. What is the average cost (in ₹) per litre of petrol if he spends ₹ 10000 each year?
(a) 54.69 (b) 55 (c) 55.69 (d) 54

70. The average monthly income of A and B is ₹ 8040; B and C is ₹ 7300; C and A is ₹ 8135. The monthly income of C is _____

71. A family consists of grandparents, parents and two grandchildren. The average age of the grandparents is 70 years, that of parents is 40 years and that of grandchildren is 10 years. What is the average age of the family? _____

72. A team of 9 persons joins in a shooting competition. The person who comes first in the competition scored 90 points. If he had scored 95 points, the average score for the team would have been 85. The team score was _____

73. The average of four consecutive even numbers and four consecutive odd numbers is 14.5. If the average of the given four even numbers is 15, then the average of given four odd numbers is _____

74. The average number of wickets taken by Kumar in 5 matches is 4. His average increases to 5 after the sixth match. How many wickets did he take in the last match? _____

75. A family comprising a husband and his wife, 2 sons and 3 daughters. The average age of family members is 24 years. If the average age of the sons is 25 years and that of the daughters is 8 years. What is the average age of the parents? _____

76. A restaurant has an average of 146 customers in a month having 30 days (first day starts from Sunday). If the average number of customers per day (except Sundays) is 130 then what is the average number of customers visits on a particular Sunday? _____

77. A shopkeeper has a sale of ₹ 7000, ₹ 8000, ₹ 5000, ₹ 9000 for four consecutive days. If on the sixth day his sale is of ₹ 7000, then how much sale must he have on the fifth day so that he get an average of ₹ 7500 for six days? _____

78. In a cricket match between India and Pakistan, Pakistan makes 319 runs in 50 overs. On chasing the run rate of India was only 4 runs per over for 20 overs. What should be the minimum run rate in the remaining overs so that India wins the match just after the last ball was bowled? _____

79. A student's marks were wrongly entered as 95 instead of 59. Due to this the average marks for the class got increased by two. The number of students in the class is _____

80. In a cricket team of 11 players, the captain is 24 years old and the vice-captain is 2 years younger than captain. The average age of the players, without considering the ages of captain and vice-captain, is two years more than the average age of the whole team. What is the average age of the team?

81. A library has an average of 200 visitors on Sundays and 155 on any other day. The average number of visitors per day in a months of 30 days if the first day of the month starts from

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	Wednesday is _____
82.	The average scores of the class for exam are as follow: Average score of the boys is 90; Average score of the girls is 81; Average score of the class is 84. If b represents number of boys and g represents number of girls then which of the following is correct? (a) $b > g$ (b) $b < g$ (c) $b = g$ (d) Data insufficient
83.	In a test, the average mark of nine students was found to be 50. Later on, it was discovered that the correct average was 46 marks because one student was misread as 84 marks instead of _____ marks.
84.	The average temperature of the first five days in a week is 35°C. If the average temperature of the last two days is also included, the average temperature of the week goes down by 2°C. Find the average temperature (in °C) for the last two days. _____
85.	The average temperature of the first ten days is 30°C. If the average temperature of the last five days is excluded, the average temperature the first five days becomes 28°C. Find the average temperature (in °C) for the last five days.
86.	The average age of male employees is 52 years and that of female employees is 42 years. The mean age of all employees is 42 years. The percentages of male and female employees are _____ and _____ respectively? (a) 80%, 20% (b) 20%, 80% (c) 50%, 50% (d) 52%, 48%

5.3 Problems on Ages and Simplifications based on Linear Equations

Before tackling any question on ages it is to be noted that if the present age of a person is 'x' years, the age of that person, n years ago was $(x-n)$ years, and the age of that person after n years will be $(x+n)$ years. Let us consider some examples:

Example: Sonam's age after 15 years will be 5 times of her age 5 years back. What is her age after 5 years from now?

Solution: Let Sonam's present age be x years. Then after 15 years, her age will be $(x+15)$ years. Her age 5 years ago was $(x-5)$. According to the question, $(x+15)=5(x-5) \Rightarrow x=10$ years; so Sonam's age after 5 years from now will be $(x+5)=10+5=15$ years.

Example: Amit wanted to withdraw x rupees and y paise from the bank. But cashier made a mistake and gave him y rupees and x paise. Neither the person nor the cashier noticed that. After spending 20 paise, the person counts the money. And to his surprise, he has double the amount he wanted to withdraw. Find x and y. (1 Rupee = 100 Paise).

Solution: As given, the person wanted to withdraw $(100x+y)$ paise. But he got $(100y+x)$ paise. After spending 20 paise, he has double the amount he wanted to withdraw, thus we have $2(100x+y)=100y+x-20 \Rightarrow 98y-199x=20$ …(i). Now by interchange x and y, amount gets double. So y should be twice of x or one more than twice of x, i.e. $y=2x$ or $y=2x+1$.

For $y=2x$ …(ii), solving (i) and (ii), we get $x=-20/3$ and $y=-40/2$, which is not possible as both x and y must be non-negative. For $y=2x+1$ …(iii), solving (i) and (iii), we get $x=26$ and $y=53$. Thus Amit wanted to withdraw ₹ 26.53.

Example [GA – 2016 (2 marks)]: A flat is shared by four first year undergraduate students. They agreed to allow the oldest of them to enjoy some extra space in the flat. Manu is two months older than Sravan, who is three months younger than Trideep. Pavan is one month older than Sravan. Who should occupy the extra space in the flat?

(a) Manu (b) Sravan (c) Trideep (d) Pavan

Solution (c): Manu's age = Sravan's age + 2 months …(i)

Sravan's age = Trideep's age – 3 months $\Rightarrow$ Trideep's age = Sravan's age + 3 months …(ii)

Pavan's age = Sravan's age + 1 month …(iii)

(i) – (ii) $\Rightarrow$ Manu's age – Trideep's age = –1 month $\Rightarrow$ Trideep's age = Manu's age + 1 month …(iv)

(i) – (iii) $\Rightarrow$ Manu's age – Pavan's age = 1 month $\Rightarrow$ Manu's age = Pavan's age + 1 month …(v)
From (iv), (v) and (i), we have Trideep's age > Manu's age > Pavan's age > Sravan's age. So among the four students Trideep is the oldest one. Hence Trideep will occupy the extra space in the flat. Thus option (c) is correct.

Exercise: 5.3

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	The age of two persons differ by 16 years. If 6 years ago, the elder one be 3 times as old as the younger one. What is the sum of their present ages (in years)? _____
2.	8 years ago, the average age of A, B and C was 50 years. 6 years ago the average age of B and C was 45. What is the present age of A? _____
3.	6 years ago, the average age of A, B and C was 50 years. 8 years ago the average age of B and C was 45. How old will be A after 8 years from now? _____
4.	The product of the ages of Amit and Neelam is 240. If twice the age of Neelam is more than Amit's age by 4 years, what is Neelam's age after 3 years? _____
5.	The present age of a father is 3 years more than 3 times the age of his son. After three year, father's age will be 10 years more than twice the age of the son. Find the father's age after 5 years from now. _____
6.	Raman was 4 times as old as his son 8 years ago. After 8 years, Raman will be twice as old as his son. What is the difference of their present ages? _____
7.	One year ago, the ratio of Geet's and and Sohan's age was 6 : 7, respectively. After four years, this ratio becomes 7 : 8. How old is Sohan presently? _____
8.	Ajeet's age after six years will be three-seventh of his father's age. Ten years ago the ratio of their ages was 1 : 5. What is Ajeet's father's age will be 10 years from now? _____
9.	Rohan was 4 times as old as his son 8 years ago. After 8 years, Rohan will be twice as old as his son. What is the sum of their ages after 5 years from now? _____
10.	In three more years, Manisha's grandfather will be six times as old as Manisha was last year. When Manisha's present age is added to her grandfather's present age, the total is 68. What is the difference between their present ages? _____
11.	One-half of Hritik's age two years from now plus one-third of his age three years ago is twenty years. How old was Hritik before 5 years from now? _____
12.	Amit is aged three times more than Rohit. After 8 years, Amit would be two and a half times of Rohit's age. After further 8 years, how many times would Rohit be of Amit's age? _____
13.	The sum of ages of five person born at the intervals of 3 years each is 50 years. What is the age of eldest person? _____
14.	Present ages of Sushil and Amit are in the ratio of 5 : 4, respectively. Three years from now, the ratio of their ages will become 11 : 9, respectively. What is Amit's age (in years) after five years? _____
15.	Six years ago, the ratio of the ages of Kamal and Sumit was 6 : 5. Four years later, the ratio of their ages will be 11 : 10. What the sum of their present ages (in years)? _____
16.	The sum of the present ages of a father and his son is 60 years. Six years ago, father's age was five times the age of the son. What is the present age of his son? _____
17.	Shikha is as much younger that Rohit as he is older than Tanmay. If the sum of the ages of Rohit and Tanmay is 50 years, what is the difference between Rohit and Shikha's age? _____ (a) 2 (b) 5 (c) 10 (d) Data insufficient
18.	Ten years ago, the age of Amit is thrice the age of Arjun. After ten years, Amit's age will be twice that of Arjun's age. The ratio of their present age is (a) 5 : 2 (b) 7 : 3 (c) 9 : 2 (d) 13 : 4
19.	Consider the following statements: (i) Shikha's present age is five times Divya's present age; (ii) Five years ago Shikha's age was twenty-five times Divya's age at that time. To determine the Shikha's present age which of the following option is correct: (a) (i) alone sufficient while (ii) alone not sufficient to answer

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(b) (ii) alone sufficient while (i) alone not sufficient to answer
(c) Both (i) and (ii) are not sufficient to answer
(d) Both (i) and (ii) are necessary to answer

20. Deepak is twice as old as Sheela. Consider the following statements about Deepak and Sheela. (i) Five years hence, the ratio of their ages would be 9 : 5; (ii) Ten years back, the ratio of their ages was 3 : 1. To find the difference in their ages, which of the following option is correct?
(a) (i) alone sufficient while (ii) alone not sufficient to answer
(b) (ii) alone sufficient while (i) alone not sufficient to answer
(c) Either (i) or (ii) alone sufficient to answer
(d) Both (i) and (ii) are not sufficient to answer

21. Average age of employees working in a department is 30 years. In the next year, ten workers will retire. Consider the following statements: (i) Retirement age is 60 years; (ii) There are 50 employees in the department. To find the average age in the next year, which of the following option is correct?
(a) (i) alone sufficient while (ii) alone not sufficient to answer
(b) (ii) alone sufficient while (i) alone not sufficient to answer
(c) Both (i) and (ii) are not sufficient to answer
(d) Both (i) and (ii) are necessary to answer

22. Consider the following statements: (i) Five years ago, Amit's age was double that of his son's age at that time; (ii) Present ages of Amit and his son are in the ratio of 11 : 6 respectively; (iii) Five years hence, the respective ratio of Amit's age and his son's age will become 12 : 7. To find the Amit's present age, which of the following option is correct?
(a) Only (i) and (ii) (b) Only (ii) and (iii)
(c) Only (i) and (iii) (d) Any two of the three

23. Consider the following statement: (i) The present age of Rohit is half of that of his father; (ii) After 5 years, the ratio of Rohit's age to that of his father's age will be 6 : 11; Rohit is 5 years younger than his brother. To find Rohit's present age, which of the following option is correct?
(a) (i) and (ii) only (b) (ii) and (iii) only
(c) (i) and (iii) only (d) All (i), (ii) and (iii)

24. Consider the following statement: (i) The ratio between the present ages of Rupali and her brother Ramesh is 3 : 4 respectively.; (ii) After 5 years the ratio between the ages of Rupali and Ramesh will be 4 : 5; Ramesh is 5 years older than Rupali. To find Rupali's present age, which of the following option is correct?
(a) (i) and (ii) only (b) (ii) and (iii) only
(c) (i) and (iii) only (d) Any two of the three

25. Consider the following statement: (i) Sameer's present age is more than Ashok's present age by 4 years; (ii) Ashok's present age is 20 years; (iii) The ratio of Ashok's present age to Sameer's present age is 5 : 6. To find the ratio between ages of Sameer and Ashok after 5 years, which of the following option is correct?
(a) (i) and (ii) only (b) (ii) and (iii) only
(c) (i) and (iii) only (d) Any two of the three

26. Consider the following statement: (i) The ratio between Amit's present age and his age after 8 years 4 : 5; (ii) The ratio between the present ages of Amit and Divya is 4 : 3; The ratio between Divya's present age and his age four years ago is 6 : 5. To find the difference between the present ages of Amit and Divya, which of the following option is correct?
(a) (i) or (iii) only (b) Any one of the three
(c) Any two of (i), (ii) and (iii) (d) All (i), (ii) and (iii) are required

27. The ratio of the present ages of Amit and Arun is 1 : 2 and 5 years back, the ratio was 1 : 3. What will be the ratio of their ages after 5 years?
(a) 1 : 3 (b) 2 : 5 (c) 3 : 5 (d) 5 : 7

28. The present ages of three sisters are in proportions 4 : 7 : 9. Eight years ago, the sum of their ages was 56. Find their present ages (in years).
(a) 8, 20, 28 (b) 16, 28, 36 (c) 20, 35, 45 (d) 24, 42, 54

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29. The ratio between the present ages of Amit and Babita is 5 : 3 respectively. The ratio between Amit's age 4 years ago and Babita's age 4 years later is 1 : 1. What is the ratio between Amit's age 4 years later and Babita's age 4 years ago?
(a) 1 : 3 (b) 2 : 1 (c) 3 : 1 (d) 1 : 2

30. The age of Amit 10 years ago was thrice the age of Ankita. Ten years later, Amit's age will be twice that of Ankita. The ratio of their present ages is:
(a) 2 : 5 (b) 7 : 3 (c) 9 : 7 (d) 13 : 4

31. Rohit got married 8 years ago. His present age is 6/5 times his age at the time of his marriage. Rohit's sister was 10 years younger to him at the time of his marriage. The age (in years) of Rohit's sister is _____

32. Father is aged three times more than his son Ram. After 8 years, he would be two and a half times of Ram's age. After further 8 years, how many times would he be of Ram's age?

33. A father said to his, " I was as old as you are at present at the time of your birth". If the father's age is 38 years now, the son's present age is _____.

34. The ratio of the ages of Swati and Varun is 2 : 5, after 8 years, their ages will be in the ratio of 1:2, the sum of their present ages (in years) is _____

35. Sachin was twice as old as Ajay 10 years back. How old (in years) is Ajay today if Sachin will be 40 years old after 10 years? _____

36. A group of fewer than 10 girls found a number of gold-coins which they were able to divide equally among them. After this division had been done, Lalita - one of the girls, suggested that it would be more equitable to divide the gold-coins by families rather than by individuals. Among the them, there were two groups with two sisters, of course Lalita was not in either group. The rest of the girls were unrelated to each other. A re-division by families would have meant that the gold-coins per family were 5 more than the gold-coins per girl. The girls argued among themselves over this way of dividing the gold-coins. Before a final decision is made, Ash - one of the girls, decided that she did not want any gold-coins. Her share was equally divided (without breaking/cutting any gold-coin) among the other girls. Finally, Lalita decided to withdraw her suggestion of dividing the gold-coins by families. How many girls were there and how many gold-coins did each girl end up with?
(a) 6, 12 (b) 12, 6 (c) 8, 16 (d) 16, 8

37. Three friends divided some bullets equally. After all of them shot 4 bullets the total number of bullets remaining is equal to the bullets each had after division. Find the original number of bullets before division. _____

38. There are four groups of Mangoes, Apples and Bananas as follows: **Group I:** 1 Mango, 1 Apples and 1 Banana; **Group II:** 1 Mango, 5 Apples and 7 Bananas; **Group III:** 1 Mango, 7 Apples and 10 Bananas; **Group IV:** 9 Mango, 23 Apples and 30 Bananas. Group II costs ₹ 300 and Group III costs ₹ 390. How much does Group I and Group IV costs?
(a) 130, 1810 (b) 120, 1710 (c) 130, 1710 (d) 120, 1810

39. A man went into a fast food restaurant and ate a meal costing Rs. 105, giving the accountant a Rs. 500 note. He kept the change, came back a few minutes later and had some food packed for his girlfriend. He gave the accountant a Rs. 100 note and received Rs. 20 in change. Later the bank told the accountant that both the Rs. 500 and the Rs. 100 notes were counterfeit. How much money did the restaurant lose? Ignore the profit of the food restaurant. _____

40. In a certain year, the number of girls who graduated from City High School was twice the number of boys. If 3/4 of the girls and 5/6 of the boys went to college immediately after graduation, what fraction of the graduates that year went to college immediately after graduation?
(a) 5/9 (b) 5/8 (c) 7/8 (d) 7/9

41. A camp-fire was attended by 49 friends. After shaking hands, each of them sat on the round table and clinked their mug with the friends to his immediate left and immediate right. How many times did the mugs clink? _____

42. Four friends - Amit, Bhavesh, Girish and Lokesh were comparing the number of pen that they owned. It was found that Girish had ten more pen than Lokesh. If Amit gave one-third to Bhavesh, and Bhavesh gave a quarter of what he then held to Girish, who then passed on a

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	fifth of his holding to Lokesh, they would all have an equal number of pen. Amit, Bhavesh, Girish and Lokesh possess _____, _____, _____, _____, respectively, pens. Give the minimal possible answer. (a) 90, 50, 55, 45 (b) 95, 55, 60, 50 (c) 90, 50, 45, 55 (d) 95, 55, 50, 45
43.	Amit and Tanmay divided a bag of Apples between them. Tanmay said, "It's not fair! You have 3 times as many Apples I have." Amit said, "OK, I will give you one Apple for each year of your age." Tanmay replied, "Still not fair. Now, you have twice as many Apples as I have." "Dear, that's fair enough as I am twice older than you.", said Amit. Amit went to Kitchen to drink water. While Amit was in Kitchen, Tanmay took apples from Amit's pile equal to Amit's age. If Amit and Tanmay have x and y number of apples finally, then which of the following relation is correct? (a) $x > y$ (b) $x < y$ (c) $x = y$ (d) Cannot be determined
44.	The sum of their (father, mother and son) ages is 70. The father is 6 times as old as the son. When the sum of their ages is twice 70, the father will be twice as old as the son. How old (in months) is the mother? _____
45.	Pinky and Shilpa met each other after long time. In the course of their conversation, Pinky asked Shilpa her age. Shilpa replied, "If you reverse my age, you will get my husbund's age. He is of course older than me. Also, the difference between our age is $1/11$ of the sum of our age." What is the present age of Shilpa? _____
46.	Difference between Geet's and Meena's age is 2 years and the difference between Meena's and Kavita's age is 5 years. What is the maximum possible value of the sum of the difference in their ages, taken two at a time? _____
47.	Simran says to Geet, "I have 3 sons. They are all less than 10 years in age and all are of different age. The product of the ages of the two younger brothers is equal to the age of the eldest brother. Also, the sum of their ages is a Prime number." How old is the eldest son? _____
48.	Two chairs and one table cost ₹ 700 and 1 chair and 2 table cost ₹ 800. If the cost of n tables and n chairs is ₹ 30000, then what is the value of n? _____
49.	The chair and six tables together cost ₹ 6200, three chairs and two tables together cost ₹ 1900. The cost (in ₹) of 4 chairs and 5 tables is _____
50.	A number consists of two digits whose sum is 10. If the digits of the number are reversed, then the number decreased by 36. Which of the following statement is/are correct? (i) The number is divisible by a composite number. (ii) The number is a multiple of a prime number. (a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)
51.	A number consists of two digits whose sum is 8. If 18 is added to the number, the digits are reversed. The number is equal to _____
52.	There are some benches in a class room having the number of rows 4 more than the number of columns. If each bench is seated with 5 students, there are two seats vacant in a class of 158 students. The number of rows is _____
53.	A number consists of two digits. The sum of the digits is 10. On reversing the digits of the number, the number decreases by 36. What is the product of the two digits? _____
54.	The sum of digits of a two-digit number is 8 and the difference between the number and that formed by reversing the digits is 18. What is the difference between the digits of the number? _____
55.	A railway ticket for a child costs half of the full fare but the reservation charge is the same on half tickets as much as on full ticket. One reserved first class ticket for a journey between two stations is ₹ 362; one full and one half reserved first class ticket cost ₹ 554. What is the reservation charge? _____
56.	A number consists of two digits, whose sum is 10. If 18 is subtracted from the number, digits of the number are reversed. What is the product of the digits of that number? _____
57.	Pooja started her job with certain monthly salary and gets a fixed increment every year. If her salary was ₹ 4200 after 3 years and ₹ 6800 after 8 years of service, then what are her initial

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salary and the annual increment, respectively?
(a) ₹ 2640, ₹ 320 (b) ₹ 2460, ₹ 320 (c) ₹ 2460, ₹ 520 (d) ₹ 2640, ₹ 520

58. A person bought 5 tickets from a station P to a station Q and 10 tickets from the station P to a station R. He paid ₹ 350. If the sum of a ticket from P to Q and a ticket from P to R is ₹ 42, then what is the fare (in ₹) from P to Q? _____

59. What is the sum of two numbers whose difference is 45 and the quotient of the greater number by the lesser number is 4? _____

60. The cost of 4 books and 3 pencils is same as that of 8 books and 1 pencil. The cost will be same as that of which one of the following?
(a) 2 books and 6 pencils (b) 5 books and 5 pencils
(c) 6 books and 2 pencils (d) 12 books and 4 pencils

61. A person bought a certain number of books for ₹ 80. If he had bought 4 more books for the same sum, each book would have cost ₹ 1 less. What is the price (in ₹) of each book? _____

62. A train started from a station with a certain number of passengers. At the first halt, $1/3^{rd}$ of its passengers got down and 120 passengers got in. At the second halt, half of the passengers got down and 100 persons got in. Then, the train left for its destination with 240 passengers. How many passengers were there in the train when it started? _____

63. If two digit number is added to a number obtained by reversing the digits of the given number, then the sum is always divisible by which one of the following numbers?
(a) 8 (b) 9 (c) 10 (d) 11

64. A boy was asked of his age by his friend. The boy said, "The number you get when you subtract 25 times my age twice the square of my age will be thrice your age." If the friend's age is 14, then the age of the boy is _____

65. There are two examination halls A and B. If 10 candidates are sent from A to B, the number of candidates in each room is the same. If 20 candidates are sent from B to A, the number of candidates in A is double the number of candidates in B. How many candidates are there in rooms A and B respectively?
(a) 100 and 80 (b) 80 and 100 (c) 70 and 140 (d) 140 and 70

66. One-fourth of Neelam's money is equal to one-sixth of Yogendra's money. If both together have ₹ 600, what is the difference between their amounts? _____

67. The electricity bill of a certain establishment is partly fixed and partly varies as the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is ₹ 1800. In another month, 620 units are consumed and the bill is ₹ 2040. What will be the electricity bill if 500 units are consumed? _____

68. Honey was twice as old as Vani 10 years ago. How old (in years) is Vani today, if Honey will be 40 years old after 10 years? _____

69. Shivan is 4 years younger than Mayank while Deepak is four years younger than Sumit but $1/5$ times as old as Shivam. If Sumit is eight years old, how many times Mayank is old as compared to Deepak? _____

70. A body of 7300 troops is formed of 4 battalions so that $1/2$ of the first, $2/3$ of the second, $3/4$ of the third and $4/5$ of the fourth are all composed of the same number 'n' of men. What is the value of n? _____

71. A part of monthly expenses of a family is constant and the remaining varies with the price of wheat. When the rate of wheat is ₹ 250 a quintal, the total monthly expenses of the family are ₹ 1000 and when it is ₹ 240 a quintal, the total monthly expenses are ₹ 980. Find the total monthly expenses (in ₹) of the family when the cost of wheat is ₹ 350 a quintal. _____

72. Ram and Mohan are friends. Each has some money. If Ram gives ₹ 30 to Mohan, then Mohan will have twice the money left with Ram. But if Mohan gives ₹ 10 to Ram, then Ram will have thrice as much as is left with Mohan. What is the sum of money (in ₹) does both have? _____

73. A man buys a certain quantity of apples, mangoes and bananas. If the mangoes were to cost the same as apples, he would have to forgo the bananas to buy the same number of mangoes as he had bought earlier (for the same total amount). The amount spent by him on mangoes

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	and bananas together is 50% more than the amount spent on apples. The total amount spent in the transaction is ₹ 140. The number of mangoes bought is the same as the number of bananas. If he wishes to buy the same number of apples as well how much additional amount (in ₹) would have to be spent by him? _____
74.	The age of man is 3 times that of his son. 15 years ago, the man was 9 times as old as his son. What will be the age (in years) of the man after 15 years? _____
75.	The sum of digit of a three-digit number is 16. If the ten's digit of the number is 3 times the unit's digit and the unit's digit is one-fourth of the hundredth digit, then what is the number? _____
76.	The product of the present ages of Simran and Gaurav is 320. Eight years after, Sarita's age will be three times the age of Gaurav. What was the age (in years) of Simran when Gaurav was born? _____
77.	The basic one-way railway fare for a child aged between 3 and 10 years costs half the regular fare for an adult plus a reservation charge that is the same on child's ticket as on the adult's ticket. One reserved ticket for an adult costs ₹ 216 and the cost of a reserved ticket for an adult and a child (aged between 3 and 10) costs ₹ 327. What is the basic fare (in ₹) for the journey for an adult? _____
78.	A manufacturer of a certain item can sell all he can produce at the selling price of ₹ 60 each. It costs him ₹ 40 in materials and labour to produce each item and he has overhead expenses of ₹ 3000 per week in order to operate that plant. The number of units he should produce and sell in order to make a profit of at least ₹ 1000 per week is _____
79.	A group consisting of 25 teachers, 20 engineers, 18 doctors and 12 salesmen visited a fair spent ₹ 1330 altogether. It was found that 5 teachers spent as much as 4 engineers; 12 engineers spent as much as 9 doctors and 6 doctors spent as much as 8 salesmen. If every person in a professional group spent the same amount, the amount (in ₹) spent by each engineer is _____
80.	One year ago, a mother was 4 times older to her son. After 6 years, her age becomes more than double her son's age by 5 years. The present ratio of their ages will be (a) 13 : 11 (b) 3 : 2 (c) 11 : 7 (d) 25 : 7
81.	A daily wage worker was paid ₹ 1700 during a period of 30 days. During this period, he was absent for 4 days and was fined ₹ 15 per day for absence. He was paid the full salary only for 18 days as he came late on other days. Those who came late were given only half the salary for that day. What was the total salary paid per month to a worker who came on time every day and was never absent? _____
82.	A two digit number is such that the product if the digit is 14. When 45 is added to the number, then the digits interchange their places. Find the number. _____
83.	In a certain party, there was a bowl of rice for every two guests, a bowl of broth for every three of them and a bowl of meat for every four of them. If in all there was 65 bowls of food, then how many guests were there in the party? _____
84.	Students of a class are made to stand in rows. If 4 students are extra in each row, there would be 2 rows less. If 4 students are less in each row, there would be 4 more rows. The number of students in the class is _____
85.	Anil is at present one-fourth the age of his father. After 16 years, he will be one-half age of his father. Find the present age of Anil's father. _____
86.	A father's age is three times the sum of the ages of his two children, but 20 years later, his age will be equal to the sum of their ages. What is father's age (in years)? _____
87.	There were 35 students in a hostel. If the number of students increases by 7, the expenses of the mess increase by ₹ 42 per day while the average expenditure per head diminishes by ₹ 1. Find the original expenditure of the mess. _____
88.	In a family, each daughter has the same number of brothers as she has sisters and each son has twice as many sisters as he has brothers. How many sons are there in the family? _____
89.	A class decided to have a party for their class at a total cost of ₹ 720. Four students decided to stay out of the party. To meet the expenses the remaining students have to increase their share by ₹ 9. What is the original cost (in ₹) per students? _____

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90.	In a class, the number of girls is one less than the number of the boys. If the product of the number of boys and that of girls is 272, then the number of girls in the class is _____
91.	If the ages of P and R are added to twice the age of Q, the total becomes 59. If the ages of Q and R are added to thrice the age of P, the total becomes 68 and if the age of P is added to thrice the age of Q and thrice the age of R, the total becomes 108. What is the age of P? _____
92.	A lamp post has half of its length in mud, $1/3$ of its length in water and $10/3$ m above the water. What is the total length of the lamp post? _____
93.	A man went to a shop and was shown some shirts costing ₹ 100 each and some trousers costing ₹ 150 each. If he has ₹ 1200 with him, what was the maximum number of trousers that he could have purchased it, if he had also wanted to purchase some shirts? _____
94.	The age of the father 5 years ago was 5 times the age of his son. At present the father's age is 3 times that of his son. What is the present age (in years) of the father? _____
95.	A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Sushil paid ₹ 45 for a book kept for 7 days, while Karan paid ₹ 25 for the book he kept for 5 days. The fixed charge and the charge for each extra day is _____ and _____, respectively. (a) ₹ 5, ₹ 10 (b) ₹ 15, ₹ 5 (c) ₹ 5, ₹ 15 (d) ₹ 10, ₹ 5
96.	Kishore has some hens and some cows. If the total number of animal heads are 59; and the total number of feet are 190, how many cows Kishore have? _____
97.	Children were fallen-in for a drill. If each row contained 4 children less, 10 more rows would have been made. But if 5 more children were accommodate in each row the number of rows would have reduced by 5. The number of children in the school is _____
98.	If 6 years are subtracted from the present age of Rajeev and the result is divided by 18, then the present age of his grandson Amit is obtained. If Amit is 2 years younger to Mahesh, whose age is 5 years, then what is the age of Rajeev? _____

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Answer Keys

Answer Keys: Exercise: 5.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	c	c	d	b	c	b	b	b	a	b	d	15	2	c
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
d	1	d	4	b	c	d	6	1	c	2	c	8	416	3
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
d	17	d	80	a	d	b	195	a	4	d	b	8	5	9
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
9	2	4	4	9	0	a	c	b	c	c	a	c	c	c
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
a	c	d	947	40	45	212	23	42	42	2114	583	a	6782	1202
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
8	302	1120	12	2	2413	7	6	a	c	b	d	b	c	d
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
9	96	9	40	3030	8	d	c	d	b	122	31	b	1	a
106	**107**	**108**	**109**	**110**	**111**									
0	b	1	153846	6	45									

Answer Keys: Exercise 5.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	c	c	a	d	a	a	264	216	a	4	70	2	3008	a
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
213	d	0.06	297	11	358	908	c	a	d	74	14	a	c	a
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
1152	10	16	15	b	6	775	a	c	5	a	b	c	c	9
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	c	d	3	d	d	35	100	17	72	504	100	55	82	45
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
20	25	69	150	8	36	18	49	a	7395	40	760	14	10	47
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**				
226	9000	8	18	32	161	b	48	28	32	a				

Answer Keys: Exercise: 5.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
44	66	62	15	38	24	36	60	66	46	19	0.5	16	29	34
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
14	d	b	d	c	d	d	a	d	d	c	c	b	c	b
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
38	2	19	56	20	a	18	b	600	d	49	a	c	350	45
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
14	6	60	3000	b	35	8	21	2	22	24	d	14	75	c
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
5	240	d	14	a	120	1680	20	6	1200	1200	96	28	75	862
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
32	210	200	17.5	d	2400	27	60	96	32	30	420	3	36	16
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**							
12	20	6	30	a	36	150	60							

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Chapter 6 : Numbers – II

6.1 Ratio, Proportion, Direct Variation, Percentage and Partnership

Ratio: A **ratio**, which is a comparison of two numbers by division, is the quotient obtained when the first number is divided by the second, non-zero number. In general, the ratio of 'a' to 'b', where $b \neq 0$, can be expressed as a/b or $a:b$ or $a \div b$. To find the ratio of two quantities, both quantities must be expressed in the same unit of measure before their quotient is determined.

Proportion: A **proportion** is an equation that states that two ratios are equal. As the ratio $4:20$ is equal to the ratio $1:5$, so we write the proportion $4:20 = 1:5$. If a,b,c,d are four numbers such that $a = c$, $b = d$, and $b,d \neq 0$, then the ratio $a:b$ proportion to the ratio $c:d$ is written as $a:b = c:d$ or $a:b::c:d$ or $a/b = c/d \Leftrightarrow ad = bc$; also this proportion can be read as 'a is to b as c is to d'.

Direct Variation: If a relationship exists between two variables so that their ratio is a constant, that relationship between the variables is called a **direct variation**. In every direct variation, we say that one variable varies directly proportional to the other. The constant ratio is called a constant of variation. It is important to indicate the order in which the variables are being compared before stating the constant of variation. For e.g. in comparing x to y, $x/y = 4/1$, the constant of variation is 4; on the other hand in comparing y to x, $y/x = 1/4$, the constant of variation is $1/4$.

Percentage

- To write a fraction as percent, we multiply the fraction by 100, and then attach '%' symbol. For e.g. $(4/25) \times 100\% = 16\%$.
- To write a percent as a fraction, we drop the % sign, multiply the number by $(1/100)$ (or divide the number by 100) and simplify it. For e.g. $16\% = 16/100 = 4/25$.
- $\text{Percentage change} = \{(\text{Absolute Value})/(\text{Original quantity})\} \times 100$

Partnership: Questions on partnership are based on ratio or proportion or direct variation or percentage, which can be solved by solving the equations made from the data provided.

Example [GA-2011 (1 mark)]: There are two candidates P and Q in an election. During the campaign, 40% of the voters promised to vote for P, and rest for Q. However, on the day of election 15% of the voters went back on their promise to vote for P and instead voted for Q. 25% of the voters went back on their promise to vote for Q and instead voted for P. Suppose, P lost by 2 votes, then what was the total number of voters?

(a) 100 (b) 110 (c) 90 (d) 95

Solution (a): From the given data we have,

Voting in favour of P is $40\% - 15\% \text{ of } 40\% + 25\% \text{ of } 60\% = 40\% - 6\% + 15\% = 49\%$.

Voting in favour of Q is $60\% - 25\% \text{ of } 60\% + 15\% \text{ of } 40\% = 60\% - 15\% + 6\% = 51\%$.

As P lost by 2 votes i.e., $51\% - 49\% = 2 \Rightarrow 2\% = 2$. As 2% of the voter is 2 voter, so total number of voters is 100%, i.e. 100 voters.

Example [GA-2010 (2 marks)]: A tank has 100 litres of water. At the end of every hour the following two operations are perforated in sequence; (i) water equal to $m\%$ of the current contents of the tank is added to the tank, (ii) water equal to $n\%$ of the current contents of the tank is removed from the tank. At the end of 5 hours the tank contains exactly 100 litres of water. The relation between m and n is:

(a) $m = n$ (b) $m > n$ (c) $m < n$ (d) None of these

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Solution (b): If this question is solved by usual method then it will take too much time and there are lots of equations. So let us solve this problem by guessing. It is to be noted that at the end of any hour we must have 100 litres of water because the quantity of water is changed after adding or removal, but the percentage of adding or removal is fixed. Suppose at the end of 1st hour, we first add 10% of 100 litres of water, which becomes 110 litres of water; we have the following cases of removal of water:
Case I: If the removal percentage is more than 10%, say 11%, then after removing 11% of 110 litres of water we have 97.9 litres of water. If instead of removing 11%, we remove 12% we have 96.8 litres of water which is less than 97.8 litres of water. If instead of removing 11%, we remove 11.5% we have 97.35 litres of water which is again less than 97.8 litres of water. So we can conclude that if removal percentage of the current content is more than the adding percentage of the current content then we never get exactly 100 litres of water.
Case II: If the removal percentage of the current content is equal to 10% then after removing 10% of 110 litres of water we have 99 litres of water. So we can conclude that if removal percentage of the current content is equal to the adding percentage of the current content then we never get exactly 100 litres of water.
Case I: If the removal percentage is less than 10%, say 9%, then after removing 9% of 110 litres of water we have 100.1 litres of water. If instead of removing 9%, we remove 9.5% we have 99.55 litres of water which is less than 100.1 litres of water. If instead of removing 9%, we remove 8.5% we have 100.65 litres of water which is more than 100.1 litres of water. So we can conclude that if the removal percentage of the current content is between 9% and 9.5%, then we can have exactly 100 litres of water. In this case the exact removing percentage is $(100/11)\%$. So option (b) is correct, i.e. the adding percentage of the current content must be $>$ the removing percentage of the current content.

Example [GA-2011 (2 marks)]: A container originally contains 10 litres of pure spirit. From this container 1 litre of spirit is replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container?
(a) 7.58 litres (b) 7.84 litres (c) 7 litres (d) 7.29 litres
Solution (d): Every time 10% of the liquid is replaced by 10% of the water. After 1st replacement, the container contains $10\times\left(1-(10/100)\right)=9$ litres of pure spirit and $10\times(10/100)=1$ litre of water. After the 2nd replacement, the container contains $9\times\left(1-(10/100)\right)=8.1$ litres of pure spirit and $1+1\times\left(1-(10/100)\right)=1.9$ litres of water. After 3rd replacement, the container contains $8.1\times\left(1-(10/100)\right)=7.29$ litres of pure spirit and $1+1.9\times\left(1-(10/100)\right)=2.71$ litres of water.

Example [GA-2011 (2 marks)]: Three friends, R, S and T shared toffee from a bowl. R took l/3rd of the toffees, but returned four to the bowl. S took l/4th of what was left but returned three toffees to the bowl. T took half of the remainder but returned two back into the bowl. If the bowl had 17 toffees left, how many toffees were originally there in the bowl?
(a) 38 (b) 31 (c) 48 (d) 41
Solution (c): Le x be the number of toffees in the bowl. So R took $\left((x/3)-4\right)$ toffees; remaining toffees in the bowl after R taken is $x-\left((x/3)-4\right)=\left((2x/3)+4\right)$. S took $(1/4)\left((2x/3)+4\right)-3=\left((x/6)-2\right)$ toffees; remaining toffees in the bowl after S taken is $\left((2x/3)+4\right)-\left((x/6)-2\right)=\left((x/2)+6\right)$. T took $(1/2)\left((x/2)+6\right)-2=\left((x/4)+1\right)$ toffees; remaining toffees in the bowl after T taken is $\left((x/2)+6\right)-\left((x/4)+1\right)=17\Rightarrow(x/4)+5=17\Rightarrow x=48$.

Example [GA-2011 (2 marks)]: Three sisters (R, S, and T) received a total of 24 toys during Christmas. The toys were initially divided among them in a certain proportion. Subsequently, R gave some toys to S which doubled the share of S. Then S in turn gave some of her toys to T, which doubled T's share. Next, some of T's toys were given to R, which doubled the number of toys that R currently had. As a result of all such exchanges, the three sisters were left with equal number of toys. How many toys did R have originally?

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(a) 8 (b) 9 (c) 11 (d) 12

Solution (c): Let initially R, S and T have x, y and z number of toys; thus $x+y+z=24$ …(i). When R gave some toys to S which doubled the share of S, i.e. R gave y toys to S so that S have $2y$ toys which is double to the initial number of toys that S have. Similarly at the end of sharing the number of toys that a sister has is given in the table. In the end, all were left with equal number of toys, thus $2(x-y)=2y-z=2z-(x-y)$ …(ii)

	R	S	T
Initially	x	y	z
R to S	$x-y$	$2y$	z
S to T	$x-y$	$2y-z$	$2z$
T to R	$2(x-y)$	$2y-z$	$2z-(x-y)$

From (ii) we get $y=7x/11$ and $z=6x/11$; on substituting these in (i) we get $x+(7x/11)+(6x/11)=24\Rightarrow x=11$.

Example [GA-2012 (2 marks)]: Raju has 14 currency notes in his pocket consisting of only Rs. 20 notes and Rs. 10 notes. The total money value of the notes is Rs. 230. The number of Rs. 10 notes that Raju has is

(a) 5 (b) 6 (c) 9 (d) 10

Solution (a): Let number of ₹10 and ₹20 notes are x and y, respectively. So $x+y=14$ ...(i); and $10x+20y=230$ …(ii). Solving (i) and (ii) we get $x=5$ and $y=9$. So the number of ₹10 notes is 5.

Example [GA-2012 (2 marks)]: The data given in the following table summarizes the monthly budget of an average household. The approximate percentage of the monthly budget NOT spent on savings is

(a) 10% (b) 14% (c) 81 (d) 86%

Category	**Amount (Rs.)**
Food	4000
Clothing	1200
Rent	2000
Savings	1500
Other expenses	1800

Solution (d): The percentage of the monthly budget NOT spent on savings is given as $\{(4000+1200+2000+1800)/(4000+1200+2000+1500+1800)\}\times 100=85.71\%\approx 86\%$.

Example [GA-2013 (2 marks)]: The current erection cost of a structure is Rs. 13,200. If the labour wages per day increase by 1/5 of the current wages and the working hours decrease by 1/24 of the current period, then the new cost of erection in Rs. is

(a) 16500 (b) 15180 (c) 11000 (d) 10120

Solution (b): Let W and T be the per day wage and per day working hour, respectively, of a labour. Currently the total cost, $WT=13200$. If W is increased by 1/5 of the current wages, the new wages per day of labour is $W'=W\left(1+(1/5)\right)=1.2W$; and if T is decreased by $1/24$ of the current period, the new working time is $T'=T\left(1-(1/24)\right)=(23/24)T$. So the new total cost is $W'T'=1.2W\times(23/24)T=(23/20)WT=(23/20)\times 13200=15180$.

Example [GA-2013 (1 mark)]: In the summer of 2012, in New Delhi, the mean temperature of Monday to Wednesday was 41°C and of Tuesday to Thursday was 43°C. If the temperature on Thursday was 15% higher than that of Monday, then the temperature in °C on Thursday was

(a) 40 (b) 43 (c) 46 (d) 49

Solution (c): Let temperatures on Monday, Tuesday, Wednesday and Thursday be M,T,W,Th, respectively. So we have $(M+T+W)/3=41\Rightarrow M+T+W=123$ …(i); $(T+W+Th)/3=43\Rightarrow T+W+Th=129$ …(ii); $Th=\left(1+(15/100)\right)M=1.15M$ …(iii); $(ii)-(i)\Rightarrow Th-M=6$ …(iv). Putting (iii) in (iv), we get $Th-\{Th/1.15\}=6\Rightarrow Th=46^{o}C$.

Example [GA-2014 (2 marks)]: One percent of the people of country X are taller than 6 ft. Two percent of the people of country Y are taller than 6 ft. There are thrice as many people in country X as in country Y. Taking both countries together, what is the percentage of people taller than 6 ft.?

(a) 3.0 (b) 2.5 (c) 1.5 (d) 1.25

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Solution (d): Let x and y be the number of people in country X and Y, respectively; so $x = 3y$, as there are thrice as many people in country X as in country Y. So $0.01x$ and $0.02y$ number of peoples in country X and Y, respectively, having height more 6 ft. So, percentage of people taller than 6 ft. is $\frac{\text{total number of people taller than 6 ft.}}{\text{total number of people in both countries}} = \frac{0.01x + 0.02y}{x + y} = \frac{0.01(3y) + 0.02y}{(3y) + y} \times 100 = 1.25\%$.

Example [GA-2014 (2 marks)]: Round-trip tickets to a tourist destination are eligible for a discount of 10% on the total fare. In addition, groups of 4 or more get a discount of 5% on the total fare. If the one way single person fare is Rs 100, a group of 5 tourists purchasing round-trip tickets will be charged Rs _____.

Solution: One way fare per person is 100; so two way fare per person is 200. As we have a group of 5 (which is more than 4) so it gets a discount of $10\% + 5\% = 15\%$. As the total fare for a round trip for 5 person is $5 \times 200 = 1000$ so after discount of 15% on Rs. 1000 i.e., $(15/100) \times 1000 = 150$. Thus the group will be charged $1000 - 150 = ₹\ 850$.

Example [GA-2014 (2 marks)]: The Gross Domestic Product (GDP) in Rupees grew at 7% during 2012-2013. For international comparison, the GDP is compared in US Dollars (USD) after conversion based on the market exchange rate. During the period 2012-2013 the exchange rate for the USD increased from Rs. 50/ USD to Rs. 60/ USD. India's GDP in USD during the period 2012-2013

(a) increased by 5% (b) decreased by 13%
(c) decreased by 20% (d) decreased by 11%

Solution (d): ₹100 has final value of $₹100\left(1 + (7/100)\right) = ₹107$. $\therefore$ $(100/50)$ \$ has final value of $(107/60)$ \$. So % increase in India's GDP in USD is $\frac{107/60 - 100/50}{100/50} \times 100 = -10.83\% \approx -11\%$.

Example [GA-2014 (2 marks)]: In a survey, 300 respondents were asked whether they own a vehicle or not. If yes, they were further asked to mention whether they own a car or scooter or both. Their responses are tabulated below. What percent of respondents do not own a scooter? _____.

		Men	Women
Own Vehicle	Car	40	34
	Scooter	30	20
	Both	60	46
Do not own vehicle		20	50

Solution: Total number of respondents is 300. The total number person who do not own scooter is $(40 + 20)$ (men) and $(34 + 50)$ (women). Thus percent of respondents do not own a scooter is $(40 + 20 + 34 + 50)/300 = 48\%$.

Example [GA-2015 (2 marks)]: The given question is followed by two statements: select the most appropriate option that solves the question. **Capacity of a solution tank A is 70% of the capacity of tank B. How many gallons of solution are in tank A and tank B?**

Statements I: Tank A is 80% full and tank B is 40% full. **Statement II:** Tank A if full contains 14000 gallons of solution.

(a) Statement I alone is sufficient. (b) Either statement I or II alone is sufficient.
(c) Statement II alone is sufficient. (d) Both the statements I and II together are sufficient.

Solution (d): Let the capacity of tank B is x; then capacity of tank B is $0.7x$. From statement II, we have $0.7x = 14000 \Rightarrow x = 20000$ gallons of solution. To find many gallons of solution are in tank A and tank B, we have to use Statement II. So in tank A, we have $(80/100) \times 14000 = 11200$ gallons of solution; and in tank B, we have $(40/100) \times 20000 = 8000$ gallons of solution. So both the statements I and II together are sufficient.

Example [GA-2015 (2 marks)]: A cube of side 3 units is formed using a set of smaller cubes of side 1 unit. Find the proportion of number of faces of smaller cubes visible to those which are NOT visible.

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(a) 1 : 4 (b) 1 : 3 (c) 1 : 2 (d) 2 : 3

Solution (c): Number of faces per cube is 6. As total number of cubes used for making a cube of side 3 units by a set of smaller cube of side 1 unit is $3\times3\times3=27$. Thus the total number of faces in a cube of side 3 units is $27\times6=162$. As on one face of a 3 unit cube there are 9 faces are visible, so total number of visible face in a cube of side 3 units is $9\times6=54$ and thus total number of non-visible face in a cube of side 3 units is $162-54=108$. So $\frac{\text{Number of visible faces}}{\text{Number of non - visible faces}}=\frac{54}{108}=\frac{1}{2}$.

Example [GA-2015 (1 mark)]: Based on the given statements, select the most appropriate option to solve the given question. What will be the total weight of 10 poles each of same weight? **Statements I:** One fourth of the weight of a pole is 15 kg. **Statement II:** The total weight of these poles is 160 kg more than the total weight of two poles.

(a) Statement I is alone is not sufficient (b) Statement II alone is not sufficient
(c) Either I or II alone is sufficient (d) Both statements I and II are not sufficient

Solution (c): Let the weight of each pole be x.

Statement 1: $x/4=15\Rightarrow x=60$ kgkg. So weight of 10 poles is $60\times10=600$ kg.

Statement 2: $10x=160+2x\Rightarrow x=20$ kg. So weight of 10 poles is $20\times10=200$ kg.

Thus from both statements we get the total weight of 10 poles and so either I or II alone is sufficient.

Example: 'A' started a software company by investing ₹ 100000. After six months, 'B' joined the company with a capital of ₹ 50000. After five years, they earned a profit of ₹ 34000. What was A's share in the profit?

Solution: Since after five years, A is associated with the company for $12\times5=60$ months; and B is associated with the company for $12\times4+6=54$ months. So the ratio of the investment in the company is $\frac{A}{B}=\frac{100000\times60}{50000\times54}=\frac{20}{9}$. Thus after five years, the A's share will be $\frac{A}{B}=34000\times\frac{20}{20+9}=$ ₹23448.28 (since the profit is ₹ 34000).

Example [GA-2016 (1 mark)]: In a huge pile of apples and oranges, both ripe and unripe mixed together, 15% are unripe fruits. Of the unripe fruits, 45% are apples. Of the ripe ones, 66% are oranges. If the pile contains a total of 5692000 fruits, how many of them are apples?

(a) 2029198 (b) 2467482 (c) 2789080 (d) 3577422

Solution (a): 15% of 5692000 fruits are unripe, so in the pile, there are $\frac{15}{100}\times5692000=853800$ unripe fruits. Thus there are $5692000-853800=4838200$ ripe fruits.

45% of 853800 unripe fruits are apples, so there are $\frac{45}{100}\times853800=384210$ unripe apples.

66% of 4838200 ripe fruits are oranges, thus 34% of 4838200 ripe fruits are apples, so there are $\frac{34}{100}\times4838200=1644988$ ripe apples. Hence total number of apples is $1644988+384210=2029198$

Example [GA-2016 (1 mark)]: (x% of y) + (y% of x) is equivalent to _____.

(a) 2% of xy (b) 2% of $(xy/100)$ (c) xy% of 100 (d) 100% of xy

Solution (a): (x% of y) + (y% of x) $=\frac{x}{100}\times y+\frac{x}{100}\times y=\frac{2xy}{100}=2\%$ of xy.

Exercise: 6.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

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1. Men, women and children are employed to do a work in the proportion of $1:2:3$ and their wages are in the proportion of $6:3:2$. When 50 men are employed, total wages of all amount to ₹ 4500. What is the weekly wages (in ₹) paid to a man, a woman and a child?
(a) 210, 105, 70 (b) 210, 170, 105 (c) 210, 170, 90 (d) 210, 105, 90

2. If $p:q=2:3$, $q:r=5:7$, $r:s=3:10$, then what is $p:s$?
(a) $1:7$ (b) $2:7$ (c) $1:5$ (d) $5:1$

3. A person distributes his pens among four friends p,q,r,s in the ratio $1/3:1/4:1/5:1/6$. What is the minimum number of pens that the person should have? _____

4. In a certain school, the ratio of boys to girls is $7:5$. If there are 2400 students in the school, then how many girls are there? _____

5. If 1 is added to the age of the elder sister, then the ratio of the ages of two sisters becomes $0.5:1$, but if 2 is subtracted from the age of the younger one, the ratio becomes $1:3$. What is the sum of ages of the two sisters? _____

6. Sex ratio is defined as the number of females per 1000 males. In a city, the total inhabitants are 1935000 out of which 935000 are females. What is the sex ratio for the place?
(a) $1000:1$ (b) $1940:1$ (c) $935:1$ (d) $935:1$

7. X and Y starts a business by contributing ₹ 1500 and ₹ 900, respectively. X is a sleeping partner and Y gets 10% of the profit for management and the rest of the profit is divided in the proportion of their capital. If the profit is ₹ 800, what is the share (in ₹) of Y? _____

8. If $x:y=7:5$, then what is the value of $(5x-2y):(3x+2y)$?
(a) $5:4$ (b) $6:5$ (c) $25:31$ (d) $31:42$

9. Mixture of milk and water has been kept in two separate containers. Ratio of milk to water in one of the container is $5:1$ and that in the other container is $7:2$. In what ratio the mixture of these two containers should be added together, so that the quantity of milk in the new mixture becomes 80%?
(a) $3:2$ (b) $2:3$ (c) $4:5$ (d) $5:4$

10. If ₹ 840 is divided among A, B and C in the ratio $1/5:1/6:1/10$, what is the share (in ₹) of A? _____

11. Mrs Sharma's expenditure and savings are in the ratio of $3:2$. Her income increases by 10%. Her expenditure also increases by 12%. How much percentage does her saving increase? _____

12. If p % of ₹ x is equal to q % of ₹ y, then what is the ratio of x to y?
(a) $pt:q$ (b) $pq:t$ (c) $qt:p$ (d) $q:pt$

13. The ratio of water to milk in three containers of equal capacity is $3:2$, $7:3$ and $11:4$, respectively. The three containers are mixed together. What is the ratio of milk to water after mixing?
(a) $41:18$ (b) $61:29$ (c) $29:61$ (d) $18:41$

14. Two vessels are full of milk with milk to water in ratio $1:3$ and $3:5$, respectively. If both are mixed in the ratio $3:2$, what is the ratio of water to milk in the new mixture?
(a) $3:10$ (b) $10:3$ (c) $4:15$ (d) $15:4$

15. In a mixture of 60 litres, the ratio of milk and water is $2:1$. If the ratio of milk and water is to be $1:2$, then the amount of water (in litres) to be further added must be _____

16. A certain amount of money has to be divided between two persons A and B in the ratio $3:5$. But it was divided in the ratio of $2:3$ and thereby B loses ₹ 10. What was the amount (in ₹)? _____

17. A man left one-half of the property for his wife. One-third to his son and the remainder to his daughter and her share was worth ₹ 45 lacs. How much money (in lacs) did the man leave? _____

18. In a class, the number of boys is more than the number of girls by 12% of the total students. What is the ratio of number of girls to that of boys?
(a) $11:14$ (b) $14:11$ (c) $28:23$ (d) $23:28$

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19. A and B entered into partnership with ₹ 700 and ₹ 600 respectively. After 3 months, A withdrew $2/7$ of his stock but after 3 months, he puts back $3/5$ of what he had withdrawn. The profit at the end of the year is ₹ 726. How much (in ₹) should A receive? _____

20. Three numbers are in the ratio $3:2:5$ and the sum of their squares is 1862. What is the sum of three numbers? _____

21. The number that must be added to each of the numbers 8, 21, 13 and 31 to make the ratio of first two numbers equal to the ratio of last two numbers is _____

22. If x varies as the m^{th} power of y; y varies as the n^{th} power of z; x varies as the p^{th} power of z, then which one of the following is correct?

(a) $p = m + n$ (b) $p = m - n$ (c) $p = mn$ (d) $p = m/n$

23. What should be subtracted from 15, 28, 20 and 38, so that the first two numbers are proportional to 3rd and 4th number? _____

24. A mixture contains milk and water in the ratio $5:1$. On adding 5 litres of water, the ratio of milk to water becomes $5:2$. What is the quantity of milk in the original mixture? _____

25. A bottle contains $3/4$ of milk and the rest is water. How much of the mixture must be taken away and replaced by an equal quantity of water so that the ratio of milk and water be $1:1$.

(a) 30% (b) $100/3\%$ (c) 40% (d) 50%

26. If a quantity y varies as the sum of three quantities of which the first varies as x, the second varies as $-x + x^2$, the third varies as $-x^2 + x^3$, then $y =$ (where k, l, m are constant)

(a) kx^3 (b) $kx + lx^2 + mx^3$ (c) kx^2 (d) kx

27. Three partners invested capital in the ratio $2:7:9$. The time period for which each of them invested was in the ratio of the reciprocals of the amount invested. Find the share (in ₹) of the partner who brought in the highest capital, if profit is ₹ 1080. _____

28. Person A started a business with a capital of ₹ 2525 and another person B joined after some months with a capital of ₹ 1200. Out of the total annual profit of ₹ 1644, A's share was ₹ 1212. When, (in months) after A started business, did B join the business as partners? _____

29. P and Q enter into a partnership with ₹ 50000 and ₹ 60000, respectively. R joins them after n months contributing ₹ 70000 and Q leaves n months before the end of the year. In they share the profit in the ratio of $20:18:21$, then the value of x is _____

30. Let y is equal to the sum of two quantities of which one varies directly as x and the other inversely as x. If $y = 6$ at $x = 4$ and $y = 10/3$ at $x = 3$, then the value of y at $x = 2$ is ____

31. A vessel contains liquid A and B in the ratio $5:3$. If 16 litres of the mixture are removed and the same quantity of liquid B is added, the ratio becomes $3:5$. What quantity (in litres) does the vessel hold? _____

32. What number must be added to each of 4, 10, 12 and 24, so that the first two numbers are in proportion to the last two numbers? _____

33. Amit, Raj, Simran and Ginny rented a house and agreed to share the rent as follows: Amit : Raj $::8:15$; Raj : Simran $::5:8$; and Simran : Ginny $::4:5$. The part of rent paid by Simran will be $x/77$. What is x? _____

34. If x varies directly as y and inversely as square of z. If $y = 4$ and $z = 14$ at $x = 10$; find the value of x when $y = 16$ and $z = 7$. _____

35. Fighting for the farmer's rights the supporter of farmer's leader outnumbered the police by $9:1$ in demonstration at the ground. The police arrested 135 farmers averaging 5 for every 3 policemen. How many farmers were there in the demonstration? _____

36. The monthly income of P and Q are in the ratio $4:3$. Each of them saves ₹ 600. If the ratio of their expenditure is $3:2$, then what is the monthly income of P? _____

37. Railway fares of 1st, 2nd and 3rd classes between two stations were in the ratio of $8:6:3$. The fares of 1st and 2nd class were subsequently reduced by $1/6$ and $1/12$, respectively. If during a

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	year, the ratio between the passengers of 1st, 2nd and 3rd classes was $9:12:26$ and total amount collected by the sale of tickets was ₹ 1088, then find the collection from the passengers of 1st class. _____
38.	In a mixture of 80 litres, the ratio of water and milk is $1:3$. If the ratio of water and milk is to be $3:2$, then how much amount (in litres) of water is to be added? _____
39.	A sink contains exactly 12 litres of water. If water is drained from the sink until it holds exactly 6 litres of water less than the quantity drained away, how many litres of water were drained away? _____
40.	x varies inversely as the square of y in such a way that, if $x=1$, then $y=6$. If $x=4$, then what is value of y? _____
41.	Three containers P, Q and R are having mixtures of water and milk in the ratio $5:1$, $5:3$ and $7:5$, respectively. If the capacities of the containers are in the ratio $5:4:5$, then find the ratio of the milk to the water if the mixtures of all the three containers are mixed together. (a) $115:53$ (b) $115:54$ (c) $54:115$ (d) $53:115$
42.	Age of A is six times that of B. After 4 years, A is four times elder of B. What is the present age (in months) of B?
43.	The number of customers visiting the restaurants A, B and C, during working days are in the ratio of $3:5:7$. On weekends if the customers in the restaurants, A, B and C, increased by 50%, 60% and 50%, respectively, what will be the new ratio of their respective number of customers? (a) $4:5:7$ (b) $3:6:7$ (c) $4:15:18$ (d) $9:16:21$
44.	If a, b, c, d and e are in continued proportion, i.e. $a/b=b/c=c/d=d/e$, then $a/e=$ (a) a^3/b^3 (b) a^4/b^4 (c) b^4/a^4 (d) b^3/a^3
45.	If $q/(p-r)=(q+p)/r=p/q$, then $p:q:r$ is (a) $1:2:3$ (b) $3:2:1$ (c) $4:2:3$ (d) $2:4:7$
46.	Two numbers are in the ratio $2:3$. If 9 is added to each number, they will be in the ratio $3:4$. What is the sum of the two numbers? _____
47.	If 24 carat gold is pure gold then find the ratio of pure gold in 18 carat (which has $3/4$ gold) and 20 carat (which has $5/6$ gold). (a) $5:8$ (b) $9:10$ (c) $15:24$ (d) $8:5$
48.	The ratio of monthly incomes and expenditures of two person is $4:5$ and $7:9$, respectively. If both persons saves ₹ 50 in every month, then what is the sum (in ₹) of their monthly incomes? _____
49.	Several litres of milk was drawn off a 54 litres of container full of mil and an equal amount of water added. Again, the same volume of the mixture was drawn off and replaced by water. As a result the container contained 24 litres of pure milk. How much (in litres) of the milk was drawn off initially? _____
50.	The dimension of rectangular cardboard when increased by 4 m are in the ratio of $4:3$ and when decreased by 4 m are in the ratio of $2:1$. The area (in m^2) of rectangular cardboard is _____
51.	A contractor employed 25 labourers on a job. He paid ₹ 275 for the work. After retaining 20% of the sum, he distributed the remaining amount amongst the labourers. If the number of women to men labourers was in the ratio $3:2$ and their wages in the ratio $4:5$, what wages (in ₹) did a woman labourer get?
52.	If $7:11::14:x$, then $x=$_____
53.	Two numbers are in the ratio $3:5$. If 9 is subtracted from each number, then they are in the ratio of $12:23$. What is the sum of two numbers? _____
54.	If $Q:R=(3/4):(2/5)$ and $P:Q=(3/5):(5/7)$, then what is $R:Q:P$? (a) $\frac{2}{5}:\frac{5}{7}:\frac{3}{5}$ (b) $\frac{2}{7}:\frac{15}{28}:\frac{9}{20}$ (c) $\frac{9}{20}:\frac{2}{7}:\frac{15}{28}$ (d) $\frac{3}{5}:\frac{5}{7}:\frac{3}{4}$

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55. A bag contains ₹ 80 in the form of ₹ 1, 50 paise and 10 paise coins in the ratio $3:8:10$. What is the number of 50 paise coins? _____

56. X is twice as old as Y 3years ago, when X was as old as Y today. If the difference between their ages at present is 3 years, how old (in years) is Y at present? _____

57. If ₹ 26 is divided among three persons A, B and C in the ratio $(1/2):(1/3):(1/4)$, then how much (in ₹) does C gets?
(a) 6 (b) 8 (c) 10 (d) 12

58. The ratio of $P:Q = x:8$, $Q:R = 12:z$ and $P:R = 2:1$, then what is the ratio of $x:z$?
(a) $2:3$ (b) $3:2$ (c) $4:3$ (d) $3:4$

59. Three numbers are in the ratio $3:2:5$ and the sum of their squares is 1862. What is the sum of the three numbers? _____

60. If $(a+b):(a-b) = 5:1$, then what is $(a^2+b^2):(a^2-b^2) =$ _____
(a) $25:3$ (b) $3:2$ (c) $17:5$ (d) $13:5$

61. The ratio between the ages of A and B is $5:2$. After 8 years, their ages will be in the ratio $2:1$. What is the sum of their present ages? _____

62. The wages of labourers in a factory has decreased in the ratio $25:22$ and their number increased in the ratio $2:3$. What was the final wage bill of the factory if the original wage bill of the factory is ₹ 5000? _____

63. If $x:y = 1:3$, $y:z = 10:1$, $z:t = 2:5$ and $t:x = 3:k$. What is the value of k? _____

64. If $x:y = 5:1$ then the ratio of x to y is v times the ratio of y to x? Then $k =$ _____

65. If $a:b = (3/2):(9/4)$ and $b:c = 2:(7/2)$ then what is $c:b:a$?
(a) $21:8:12$ (b) $8:21:12$ (c) $21:12:8$ (d) $12:8:21$

66. A bag contains ₹ 120 in the form of ₹ 1, 50 paise and 10 paise coins in the ratio $3:4:10$. What is the number of ₹ 1 coins? _____

67. 10 years ago, Ram was 5 times as old as Shyam but 20 years later from now he will be only twice as old as Shyam. How many years old is Shyam after 5 years from now? _____

68. What is the number which has to be added to each term of the ratio $68:49$ so that it becomes $4:3$? _____

69. If 80 is divided into three parts which are proportional to 1, $1/2$, $1/6$, then what is the extreme left part? _____

70. A bag contains 50 paise, ₹ 1 and ₹ 2 coins in the ratio $2:3:4$. If the total amount is ₹240, what is the sum of number of ₹ 1 and ₹ 2 coins? _____

71. Six years hence a father's age will be three times his son's age and three years ago father was nine time as old as his son. What is the ratio of present age of father to son?
(a) $5:1$ (b) $6:1$ (c) $7:1$ (d) $8:1$

72. One year ago, the ratio between Mohan's and Sohan's salaries was $3:5$. The ratio of their individual salaries of last year and present year are $2:3$ and $4:5$, respectively. If their total salary for the present year is ₹ 43000, what is the present salary of Sohan?
(a) ₹ 19000 (b) ₹ 18000 (c) ₹ 25000 (d) ₹ 20000

73. The sum of the squares of three numbers is 532 and the ratio of both of the first to the second and second to the third is $3:2$. What is the first number? _____

74. P, Q and R are three partners. They altogether invested ₹ 14000 in business. At the end of the year P got ₹ 337.50, Q got ₹ 1125 and R got ₹ 637.50 as profit. The difference between the investments (in ₹) of Q and R is _____

75. Three numbers P, Q and R are in the ratio of $12:15:25$. If sum of these numbers is 312, ratio between the difference of R and Q and the difference between Q and P is
(a) $3:7$ (b) $7:3$ (c) $3:10$ (d) $10:3$

76. There are two bottles containing a mixture of alcohol, water and wine. The first bottle contains alcohol, water and wine in the ratio $2:5:3$. The second bottle contains wine and water in the ratio $4:5$. One litre of the first and two litres of the second are mixed together. What fraction

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	of the mixture is alcohol? (a) $6/17$ (b) $1/15$ (c) $6/13$ (d) $2/15$
77.	Two vessel contain spirit of 0.5 and 0.75 concentrations. If two litres from the first vessel and three litres from the second vessel are mixed, then what will be the ratio of the water and spirit in the resultant solution? (a) $17:15$ (b) $17:7$ (c) $7:13$ (d) 17:15
78.	The incomes of Chinmay and Kiran are in the ratio $9:4$ and their expenditures are in the ratio $7:3$. If each saves ₹ 2000, then Chinmay's expenditure is (a) ₹ 60000 (b) ₹ 70000 (c) ₹ 80000 (d) ₹ 90000
79.	One container contains some acid and another container contains an equal quantity of water. To prepare a solution, 20 litres of the acid is poured into the second container. Then two-third of the so-formed solution is poured from the second container into the first. If the mixture in the first container is four times that in the second container, what quantity (in litres) of water was taken initially? _____
80.	The ratio between the number of passengers travelling by I and II classes between the two railway stations is $1:50$. Between the same stations the fare of I class is 3 times the fare of II class. If on a particular day, ₹ 1325 were collected from the passengers travelling between these stations, then what was the amount (in ₹) collected from the II class passengers? _____
81.	A mixture of 45 litres of spirit and water contains 20% of water in it. How much water (in litres) must be added to make the water 25% in the new mixture? _____
82.	A bottle is full of milk. One-third of it is taken out and then an equal amount of water is poured into the bottle to fill it. This process is repeated four times. Find the final ratio of milk and water in the bottle? (a) $13:55$ (b) $20:74$ (c) $16:65$ (d) $10:48$
83.	In a proportion the product of 1^{st} and 4^{th} terms is 40 and that of 2^{nd} and 3^{rd} terms is $2.5x$. What is the value of x? _____
84.	A chemist has 10 litres of a solution that is 10% sulphuric acid by volume. To dilute the solution to 4% strength, how much (in litres) he should add water. _____
85.	The ratio of the rate of flow of water in pipes varies inversely as the square of the radius of the pipes. What is the ratio of the rates of flow in 2 pies of diameter 4 cm and 2 cm? (a) $2:1$ (b) $1:2$ (c) $4:1$ (d) $1:4$
86.	A bag contains ₹ 216 in the form of ₹ 1, 50 paise and 25 paise coins in the ratio $2:3:4$. The number of 50 paise coins is _____
87.	A sum of ₹ 370 is to be divided among A, B and C such that A gets 75% of B which gets 75% of C. Then A's share (in ₹) is _____
88.	If the ratio of boys to girls in a class is $x:1$ and the ratio of girls to boys is $y:1$, then $3(x+y)$ is (a) $=3$ (b) <3 (c) >3 (d) $<1/3$
89.	If $a:b=2:5$, then ratio of $(2a+3b)$ to $(7a+5b)$ is (a) $19/39$ (b) $99/13$ (c) $31/99$ (d) $19/31$
90.	₹ 770 have been divided among A, B and C such that A receives $2/9$ of what B and C together. What is the sum of B's and C's share? _____
91.	If ₹ 1066 are divided among A, B, C and D such that $A:B=3:4$, $B:C=5:6$ and $C:D=7:5$, which of the two person will get neither maximum nor minimum? (a) A and B (b) B and C (c) C and D (d) B and D
92.	Two numbers are such as the square of one is 224 less than 8 times the square of the other. If the numbers be in the ratio of $3:4$, the sum of the two numbers is _____
93.	If a and b varies inversely with each other. If at $a=12$, $b=9$, then which of the following pairs corresponding to a and b is not possible? (a) 3 and 36 (b) 6 and 18 (c) 12 and 18 (d) 2 and 54
94.	The first, second and third class fares between two stations were $10:8:3$ and the number of

	first, second and third class passengers between the two stations in a day was $3:4:10$. The sale of tickets to passengers running between two stations on that day was ₹ 8050. How much was realized by the sale (in ₹) of first class tickets? (a) 2625 (b) 2526 (c) 2800 (d) 4500
95.	The sum of the reciprocals of the ages of two sisters is five times the difference of the reciprocals of their ages. If the ratio of the product of their ages to the sum of their ages is $14.4:1$, find the product of their ages. _____
96.	Anupam is working partner and Bimla is a sleeping partner in a business. Anupam invest ₹ 5000 and Bimla invest ₹ 6000. Anupam receives 12.5% of the profit for managing the business and the rest id divided in proportion to their capital. What does Bimla get (in ₹) for a profit of ₹ 880? _____
97.	A and B are partners in a business. A contributed $1/3$ of the capital for nine months and B received $2/5$ of the profits. For how long (in months) was B's money used in the business? _____
98.	A person ordered 4 black colour shirts and some brown colour shirts. The price of a black shirt is double that of a brown shirt. While preparing the bill, the clerk did a mistake and interchanged the number of black and brown shirts. This increased th bill by 50%. How many brown colour shirts did the person ordered originally? _____
99.	Three friends Amit, Babita and Chinmay divided ₹ 1105 amongst them in such a way that if ₹ 10, ₹ 20, ₹ 15 are removed from the sums that Amit, Babita and Chinmay received respectively, then the share of the sums that they got will be in the ratio of $11:18:24$. How much (in ₹) did Amit receive before removing ₹ 10 from his share? _____
100.	$1/3^{rd}$ of the contents of a container evaporated on the 1^{st} day. $3/4^{th}$ of the remaining contents of the container evaporated on the second day. What part of the contents of the container is left at the end of the second day? (a) $1/6$ (b) $1/7$ (c) $1/8$ (d) $1/5$
101.	At the start of a seminar, the ratio of the number of male participants to the number of female participants was $3:1$. During the lunch break, 16 male participants left and 6 more frmale participants registered. The ratio of the male to the female participants became $2:1$. The total number of male participants at the start of the seminar was _____.
102.	Sita and Geeta enter into a partnership. SIta invests ₹ 5000 while Geeta invests ₹ 4000. After one month, Geeta withdraws 25% part of her contribution and after 3 months from the starting, Sita invests ₹ 2000 more. When Geeta withdraws her money Ritu also joins them with ₹ 7000. If at the end of one year, there is profit of ₹ 1536, what will be the share (in ₹) of Ritu in the profit? _____
103.	Divide ₹ 671 among A, B and C such that if their share is increased by ₹ 3, ₹ 7 and ₹ 9, respectively, the final share will be in the ratio of $1:2:3$. How much amount (in ₹) B received before increment in the share?
104.	Half the girls and one-third of the boys of a college reside in the hostel. What fractional part of the student body is hostel dwellers if the total number of girls in the college is 100 and is 25% of the total strength? (a) $2/5$ (b) $5/12$ (c) $1/6$ (d) $15/40$
105.	The total emoluments of A and B are equal. However, A gets 70% of his basic salary as allowances and B gets 80% of his basic salary as allowances. What is the ratio of the basic salaries of A and B? (a) $7:8$ (b) $8:7$ (c) $3:2$ (d) $2:3$
106.	A water pipe is cut into two pieces. The longer piece is 70% of the length of the pipe. By how much percentage is the shorter piece shorter than the longer piece? (a) $(400/3)\%$ (b) $(400/7)\%$ (c) 140% (d) 40%
107.	What is 5% of 50% of 1000? _____
108.	The radius of the base of a right circular cone is increased by 15% keeping the height fixed. The volume of the cone will be increased by

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	(a) 32% (b) 32.25% (c) 32.50% (d) 32.75%
109.	What is the number whose 20% is 60% of 40? _____
110.	38 litres of milk was poured in a container and the container was found to be 5% empty. To completely fill the tub, what amount (in litres) of additional milk must be poured?
111.	If 50% of $(x-y) = 40\%$ of $(x+y)$, the what percentage of x is y? (a) $91/9\%$ (b) $100/9\%$ (c) $118/9\%$ (d) $190/9\%$
112.	The number of workers in a factory increased by 15 which resulted into an increase of 20%. What was the initial number of workers? _____
113.	If the radius of the base and the height of a right circular cone are increased by 20%, then what is the approximate percentage increase in volume? _____
114.	If the length of a rectangle is increased by 10% and the area is unchanged, then by how much percentage does the breadth decrease? _____
115.	A, B and C has taken a dinner together. The cost of the meal of C was 20% more than that of B and the ratio of cost of the meal of A to cost of meal of C was $5:6$. If B paid ₹ 100, then what was the total amount (in ₹) that all the three of them had paid?
116.	A man loses 40% of his money. After spending 25% of the remainder, he has ₹ 360 left. What is the amount (in ₹) of money he originally had? _____
117.	The income of A is 20% higher than that of B. The income of B is 25% less than of C. What percentage less is A's income from C's income? _____
118.	If the height of the cone is increased by 50%, then what is the percentage increase in the volume of the cone? _____
119.	If salary of A is 20% more than salary of B, then by how much percentage is salary of B less than A? _____
120.	The population of a village increases by 20% in one year and decreases by 20% by the next year. If at the beginning of the third year, the population is 5184, what was the population in the first year? _____

6.2 Profit, Loss, Simple Interest (SI) and Compound Interest (CI)

Profit and Loss

Profit: When a person does a business transaction and gets more than what he had invested, then he is said to have profit. So profit can be understood as the extra money one gets other than what he had invested. For e.g. a person bought an article for ₹ 100 and sold it for ₹ 120. Then his profit is ₹ 20.

Loss: When a person gets an amount less than what he had invested, then he is said to have a loss. The loss will be equal to the deficit he got than the investment. For e.g. a person bought an article at ₹ 100 and sold it for ₹ 90. Then he got a deficit of ₹ 10 and so his loss is ₹ 10.

The following are the terms regarding profit and loss:

- **Cost Price (CP):** The money that the trader puts in his business is called Cost Price. The price at which the articles are bought is called Cost Price. Cost Price is the investment in the business.
- **Selling Price (SP):** The price at which the articles are sold is called the Selling Price. The money that the trader gets from the business is called Selling Price. Selling Price is nothing but the returns from a business.
- **Marked/Market/List Price (MP):** The price that a trader marks or lists his articles to is called the Marked Price. This is the only price known to the customer.
- **Discount and Net Selling Price:** The waiver of cost from the Marked Price that the trader allows a customer is called Discount. In case of discount selling, the price of the article obtained by subtracting discount from the marked price is called Net selling Price.
- **Profit or Gain:** If S.P. > C.P., the seller is said to have a profit or gain. Thus $\text{Gain} = \text{S.P.} - \text{C.P.}$
- **Loss:** If S.P. < C.P., the seller is said to have incurred a loss. Thus $\text{Loss} = \text{C.P.} - \text{S.P.}$
- Loss or gain is always reckoned on C.P.
- Profit or loss percentage is to be applied always to the Cost Price only.

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- Discount percentage is to be applied always to the Marked Price only.
- $\text{Gain \%} = \dfrac{\text{Gain} \times 100}{\text{C.P.}}$; $\text{Loss \%} = \dfrac{\text{Loss} \times 100}{\text{C.P.}}$
- $\text{Selling Price (S.P.)} = \dfrac{100 + (\text{Gain or Loss})\%}{100} \times \text{C.P.}$; ' + ' sign for Gain and ' – ' sign for Loss.
- $\text{Cost Price (C.P.)} = \dfrac{100}{100 + (\text{Gain or Loss})\%} \times \text{S.P.}$; ' + ' sign for Gain and ' – ' sign for Loss.
- If an article is sold at a gain of say 35%, then S.P. = 135% of C.P.
- If an article is sold at a loss of say, 35% then S.P. = 65% of C.P.
- When a person sells two similar items, one at a gain of say $x\%$, and the other at a loss of $x\%$, then the seller always incurs a loss given by: $\text{Loss \%} = \left(\dfrac{\text{Common Loss and Gain}}{10}\right) = \left(\dfrac{x}{10}\right)^2$
- If a trader professes to sell his goods at cost price, but uses false weights, then $\text{Gain \%} = \left(\{(\text{Error})/(\text{True Value} - \text{Error})\} \times 100\right)\%$.

Example [GA-2013 (2 mark)]: A firm is selling its product at Rs. 60 per unit. The total cost of production is Rs. 100 and firm is earning total profit of Rs. 500. Later, the total cost increased by 30%. By what percentage the price should be increased to maintained the same profit level.
(a) 5 (b) 10 (c) 15 (d) 30
Solution (a): Let x number of products is to be sold. So net profit is (selling price – cost price) i.e., $60x - 100 = 500 \Rightarrow x = 10$. Now the cost price is increased by 30%, i.e. 130; so for having the same profit, let S be the selling price, thus we have $S \times x - 130 = 500 \Rightarrow S \times 10 = 630 \Rightarrow S = 63$. So the percentage increase in the selling price is $\{(63 - 60)/60\} \times 100 = 5\%$.

Example [GA-2014 (1 mark)]: A foundry has a fixed daily cost of Rs 50,000 whenever it operates and a variable cost of Rs 800Q, where Q is the daily production in tonnes. What is the cost of production in Rs per tonne for a daily production of 100 tonnes? _____.
Solution: Fixed cost is ₹50000; Variable cost is ₹800Q, where Q is the daily production in tonnes. For 100 tonnes of daily production, the total cost of production is $50000 + 800 \times 100 = 130000$. Thus the cost of production per tonne of daily production is $130000/100 = 1300$.

Simple Interest and Compound Interest: Before discussing about Simple and Compound interest, the following point should be discussed:
- The person who lends money is the **Creditor** and the person who borrows money is the **Debtor**.
- The amount of money that is initially borrowed is called the **Capital** or **Principal money**.
- The period for which money is deposited or borrowed is called **Time**.
- The extra money that will be paid or received for the use of the principal after a certain period is called the **total interest** on the principal money.
- The sum of the principal money and the interest at the end of any time is called the **Amount**.
- **Rate of interest** is the rate at which the interest is calculated and is always specified in percentage terms.

Simple Interest (S.I.): Simple interest is calculated on the original principal amount only. Accumulated interest from prior periods is not used in calculations for the following period. Let, Principal Money = ₹ P; Time = T years; Rate of interest per annum = r %; Simple interest = ₹S.I.. Then $\text{S.I.} = \dfrac{P \times t \times r}{100}$; and $\text{Amount} = \text{Principal} + \text{Simple interest} \Rightarrow \text{Amount}(A) = P + \dfrac{P \times t \times r}{100}$.

Compound Interest: In monetary transactions, the creditor and the debtor, in order to settle an account, agree on a certain amount of interest to be paid to the creditor on the basis of specified unit

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of time. This may be yearly, semi-annually or half-yearly, quarterly, or even continuously, with the condition that the interest accrued to the principal at a certain interval of time be added to the principal so that the total amount at the end of an interval becomes the principal for the next interval. In other words, the interest for the first interval is added to the principal and this amount becomes the principal for the second interval, and so on. Let, Principal Money = ₹ P; Time = n years; Rate of interest per annum = r %; A = total amount after n years.

- When the compound interest reckoned yearly, then $A = P\left(1+\frac{r}{100}\right)^n$
- When the compound interest reckoned half-yearly, then rate = $(r/2)$ % and time = $2n$ half-years. So $A = P\left(1+\frac{r/2}{100}\right)^{2n}$
- When the compound interest reckoned quarterly, then rate = $(r/4)$ % and time = $4n$ quarter-years. So $A = P\left(1+\frac{r/4}{100}\right)^{4n}$
- In general, when the compound interest reckoned k^{th} part of a year, then rate = (r/k) % and time = $4k$ k^{th}-years. So $A = P\left(1+\frac{r/k}{100}\right)^{4k}$

Example [GA-2014 (1 mark)]: The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?
(a) 3 – 4 years (b) 4 – 5 years (c) 5 – 6 years (d) 6 – 7 years
Solution (a): After 1 year the population is $5\left(1+(20/100)\right)=6$ million. After 2 years the population is $6\left(1+(20/100)\right)=7.2$ million. After 3 years the population is $7.2\left(1+(20/100)\right)=8.64$ million. After 4 years the population is $8.64\left(1+(20/100)\right)=10.368$ million, which is more than double of initial population. So the population will double in 3 – 4 years.

Example [GA-2014 (2 mark)]: Industrial consumption of power doubled from 2000-2001 to 2010-2011. Find the annual rate of increase in percent assuming it to be uniform over the years.
(a) 5.6 (b) 7.2 (c) 10.0 (d) 12.2
Solution (b): Let A be the total consumption; P be the principal consumption; r be the % rate of consumption per annum; and n be the time span in years. As per given data we have $A = 2P$, $n = 10$; so $A = P\left(1+\frac{r}{100}\right)^n \Rightarrow 2P = P\left(1+\frac{r}{100}\right)^{10} \Rightarrow \ln 2 = 10\ln\left(1+\frac{r}{100}\right) \Rightarrow r = 7.17\% \approx 7.2\%$.

Example [GA-2010 (1 mark)]: A person invests Rs.1000 at 10% annual compound interest for 2 year? At the end of two years the whole amount is invested at an annual simple interest of 12% for 5 years. The total value of the investment finally is:
(a) 1776 (b) 1760 (c) 1920 (d) 1936
Solution (d): For the first two years, the amount is invested compounded for 2 years. Let A be the total amount; P be the principal amount; r be the % rate per annum; and n be the time span in years. As per given data we have, $n = 2$, $P = 1000$, $r = 10\%$.
So $A = P\left(1+\frac{r}{100}\right)^n \Rightarrow A = 1000\left(1+\frac{10}{100}\right)^2 = 1210$. So at the end of first two years the amount become ₹1210. Now the amount ₹1210 is invested at an annual simple interest of 12% for 5 years. So let A' be the total amount after 5 years; $P' = 1210$ be the principal amount; $r' = 12\%$ be the rate of

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interest; $n' = 5$ years be the time span in years; thus we have $A' = P' + \frac{P'r'n'}{100} = 1210 + \frac{1210 \times 12 \times 5}{100} = 1936$.

Depreciation of Value: If you buy a car or any other item, its value decreases with the time. This decrease is called depreciation. If V_0 is the value at a certain time and r% per annum is the rate of depreciation per year, then the value V_t at the end of t years is $V_t = V_0\left(1 - \frac{r}{100}\right)^t$.

Exercise: 6.2

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. A person has two lots of potato with equal quantity, one costing ₹ 10 per kg and the other costing ₹ 15 per kg. By mixing together and selling whole lot at ₹ 15 per kg, the person is in profit or loss?
(a) 20% profit (b) 20% loss (c) 15% profit (d) 15% loss

2. The cost of two articles are in the ratio $3:5$. If there is 30% loss on the first article and 20% gain on the second article, what is overall percentage of loss or gain?
(a) 1.25% gain (b) 1.25% loss (c) 2.25% gain (d) 2.25% loss

3. By selling 9 dozen pencils, a shopkeeper gains the selling price of 1 dozen pencils. What is the gain percentage? _____

4. A milk vendor bought 28 litres of milk at the cost of ₹ 8.50 per litre. After adding some water, he sold the mixture at the same price. If he gains 12.5%, how much water (in litres) did he add? _____

5. A computer and a laptop were sold for ₹ 12000 each. The computer was sold at a loss of 20% of the cost and the laptop at a gain of 20% of the cost. The entire transaction results in which one of the following?
(a) No loss or gain (b) Loss of ₹ 1000 (c) Gain of ₹ 1000 (d) Loss of ₹ 1500

6. By giving 25% discount a person earns 25% profit. If he sells the items at 10% discount, what is his profit percentage? _____

7. A shopkeeper earns a profit of 20% by selling 80 kg of wheat which cost is ₹ 240 but he gives one-fourth of it to his friend at cost price and sells the remaining quantity of wheat. In order to earn the same profit, at what price (in ₹) per kg must he sell remaining quantity of wheat? _____

8. A person bought 8 quintal of wheat for certain amount. After a week, he sold 3 quintal of wheat at 10% profit, 3 quintal with neither profit nor loss, and 2 quintal at 5% loss. What is the profit percentage? _____

9. One shirt was purchased for ₹ 564 after getting a discount of 6% and another shirt was purchased for ₹ 396 after getting a discount of 1%. Taking both the items as a single transaction, what is the percentage of discount? _____

10. A shopkeeper professes to sell his goods at cost price, but uses a false weight and so he gains 20%. For a kilogram he uses a weight (in kg) of _____

11. Successive discounts of 12.5% and 7.5% are given on the marked price of a cupboard. If the customer pays ₹ 2590, then what is the marked price (in ₹)?

12. A person sold an item for ₹ 136 and got 15% loss. If he sold it for ₹ x, he would have got a profit of 15%. What is x (in ₹)?

13. A person buys 2 lemons for ₹ 1 and sells 5 lemons for ₹ 3. What is his gain percentage? _____

14. A person bought a number of apples at 3 for ₹ 1 and an equal number at 2 for ₹ 1. At what price (in ₹) per dozen should he sell them to make a profit of 20%? _____

15. The marked price of a machine is ₹ 1800. By selling it at a discount of 20%, the loss is 4%. What is the cost price (in ₹) of the machine? _____

16. A trader marked a machine 40% above the cost price and then gave a discount of 10%. He

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made a net profit of ₹ 468 after paying a tax of 10% on the gross profit. What is the cost price (in ₹) of the machine? _____

17. A trader marks 10% higher than the cost price. He gives a discount of 10% on the marked-price. In this kind of sales how much percentage does the trader gain or loss?
(a) 1% gain (b) 1% loss (c) 2% gain (d) 2% loss

18. A trader sells two cycles at ₹ 1188 each and gains 10% on the first and loses 10% on the second. What is the profit or loss percentage on the whole?
(a) 1% gain (b) 1% loss (c) 2% gain (d) 2% loss

19. A man buys 4 tables and 5 chairs for ₹ 1000. If he sells the tables at 10% profit and chairs 20% profit, he earns a profit of ₹ 120. What is the sum (in ₹) of cost of one table and one chair? _____

20. The principal (in ₹) on which a simple interest of ₹ 55 will be obtained after 9 months at the rate of $11/3\%$ per annum is _____

21. A sum of money becomes 3 times in 5 years. In how many years will the same sum become 6 times at the same rate of simple interest? _____

22. A sum of money on compound interest amount to ₹ 9680 in two years and to ₹ 10648 in three years. What is the rate of interest (in %) per annum? _____

23. A person borrowed ₹ 7500 at 16% compound interest. How much does he have to pay at the end of two years to clear the loan?
(a) ₹ 10092 (b) ₹ 11000 (c) ₹ 11900 (d) ₹ 11062

24. The compound interest on a sum for two years is ₹ 832 and the simple interest on the same sum at the same rate for the same period is ₹ 800. What is the rate of interest (in %)? _____

25. Ram has ₹ 200000, part of which he lent at 15% per annum and rest at 12% per annum. Yearly interest accrued was ₹ 27600. How much (in lacs ₹) did he lent at 15%?

26. An amount at compound interest doubles itself in four years. In how many years will the amount become 8 times itself? _____

27. A man borrowed ₹ 40000 at 8% simple interest per year. At the end of second year, he paid back certain amount and at the end of fifth year, he paid back ₹ 35960 and cleared the debt. What is the amount did he pay back after the second year?
(a) ₹ 18800 (b) ₹ 16600 (c) ₹ 17400 (d) ₹ 19600

28. A certain sum at simple interest amounts to ₹ 1350 in five years and to ₹ 1620 in 8 years. What is the sum (in ₹)? _____

29. The sum of money lent on simple interest triples itself in 15 years and 6 months. In how many months still it be doubled? _____

30. The simple interest on a certain sum of money for three years at 8% per annum is half the compound interest on ₹ 4000 for two years at 10% per annum. What is the sum (in ₹) placed on simple interest?

31. A person invests his money in a government scheme which gives him a compound interest of 20%, compounded annually. Find the least number of complete years after which his sum will be more than double. _____

32. A person deposited equal sums of money are in two different banks, one at compound interest, compounded annually and the other at simple interest, both at 5% per annum. If after two years, the difference in the amounts comes to ₹ 200. So the amounts deposited in the bank is ₹ $\_\_\_\_\times 10^3$.

33. The present population of a village is 5500. If the number of females increases by 11% and the number of males increases by 20%, then the population will becomes 6330. What is the present population of males in the village? _____

34. A person bought a machine for ₹ 25000 after getting a discount of 15% from a company. He then want to sell the machine to another person by fixing up the selling price in such a way that he earned a profit of 8% on original company price. The approximate total selling price is ₹ $\_\_\_\_\times 10^3$.

35. A person sold a shirt at a profit of 17.5%. If he had bought it at 8% less and sold it at 30% profit, he would have earned ₹ 11.55 more as profit. What is the cost price of the shirt (in ₹)?

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_____

36. What is the maximum percentage discount that a shopkeeper can offer on a marked price so that he ends up selling at no profit or loss, if he had initially marked his items up by 50%?

_____

37. A person invested a certain sum of money in a simple interest bond whose value grew to ₹ 300 at the end of three years and to ₹ 400 at the end of another five years. Find the rate of interest (in %) in which he invested his money? _____

38. A person got 30% concession on the labelled price of an item and sold it at ₹ 8750 with 25% profit on the price he bought. The labelled price was ₹ $\_\_\_\_\times 10^3$.

39. What percent (in %) selling price would be 50% of cost price, if gross profit is 26% of the selling price? _____

40. A person purchased a computer system and a colour printer. If he sold the computer system at 10% loss and the colour printer at 20% gain, he would not lose anything. But if he sells the computer system at 5% gain and the colour printer at 15% loss, he would lose ₹ 800 in the bargain. Thus he pay ₹ $\_\_\_\_\times 10^3$ for the computer system.

41. If a person invests an amount of ₹ 9535 at the rate of 4% per annum, for how many years did she invest the amount to obtain the double his sum? _____

42. After reducing the marked price by ₹ 32, a person in an electronic shop makes a profit of 15% by selling a transistor. If the cost price of transistor is ₹ 320, what percentage of profit would the person have made if he had sold the transistor at the marked price? _____

43. The difference between compound interest and simple interest on a sum of money in first two years is ₹ 20, and in first three years is ₹ 61. Find the sum (in ₹). _____

44. The difference between the compound interest and the simple interest on a certain sum of money for two years is 15% per annum is ₹ 45. Find the sum (in ₹). _____

45. If the selling price of an item is increased by ₹ 162, then the business would make a profit of 17% instead of a loss of 19%. The cost price of the product (in ₹) is _____

46. The ratio of amount for two years under compound interest annually and for one year under simple interest is $6:5$. When the ratio of interest is same, then the value of the rate of interest (in %) is _____

47. The cost price of 20 items is the same as the selling price of n items. If the profit is 25%, then the value of n is _____

48. Arun gave ₹ 1200 on loan. Some amount he gave at 4% per annum simple interest and remaining at 5% per annum simple interest. After two years, he got ₹ 110 as interest. The amount (in ₹) given at 5% per annum is _____

49. Suman borrowed a certain sum from Arun at a certain rate of simple interest for two years. He lent this sum to Ravi at the same rate of interest compounded annually for the same period. At the end of two years, he received ₹ 4200 as compound interest but paid ₹ 4000 only as simple interest, find the rate of interest (in %).

50. If the selling price of a water geyser is ₹ 1265. If the manufacturer gains 10%. The wholesale dealer gains 15% and the retailer gains 25%, then the cost (in ₹) of the product is _____

51. Sameer purchased a bag with a price tag of ₹ 600 in a sale where 25% discount was being offered on the tag price. He was given a further discount of 10% on the amount arrived at after giving usual 25% discount. What was the final amount (in ₹) paid by him? _____

52. The profit on selling an item is 320% of the cost. If the cost is increased by 25% but the selling price remains same, then what percentage (in %) of the selling price is the profit?

_____

53. Ravi took a loan of ₹ 2000 from a finance company to purchase one second hand bike. He decided to make the payment after three years. The company charges compound interest at the rate of 10% per annum for the same. But the company inform him to charge the interest at the rate of 15% per annum for the last one year of the loan period. What extra amount (in ₹) does Ravi have to pay due to increased rate of interest? _____

54. A person bought a certain number of DVDs for ₹ 1800. Keeping one to himself, he sold the rest at a profit of ₹ 6 each. In total, he earned a profit of ₹ 114. The total number of DVDs he bought is _____

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55. If ₹ 1000 be invested at interest rate of 5% and the interest be added to the principal after 10 years, then the number of months in which it will amount to ₹ 2000 is _____

56. A manufacturer sold a machine to a wholesale dealer at a profit of 10%. The wholesale dealer sold it to a retailer at a profit of 20%. While transporting some defect occurred in the machine and so the retailer sold it at a loss of 5%. The customer paid ₹ 627. Find the cost (in ₹) of machine for the manufacturer? _____

57. A person invested some amount at the rate of 12% simple interest and a certain amount at the rate of 10% simple interest. He received yearly interest of ₹ 130. But if he had interchanged the amount invested, he would have received ₹ 4 more as interest. How much (in ₹) did he invest at 12% simple interest? _____

58. The population of a village was 360 three years back. It is 480 right now. What will be the population three years down the line, if the rate of growth of population has been constant over the years and has been compounding annually? _____

59. A trader owes a merchant ₹ 10028 due one year, hence the trader wants to settle the account after three months. If the rate of interest is 12% per annum, how much amount (in ₹) should he pay? _____

60. Simran bought a watch with 24% discount on the selling price. If the watch cost her ₹ 779, what is the original selling price (in ₹) of the watch? _____

61. A man sells an item at a profit of 20%. If he had bought it at 20% less and sold it for ₹ 18 less, he would have gained 25%. The cost price (in ₹) of the book is _____.

62. The present worth of a bill due 7 months, hence is ₹ 1200. If the bill were due at the end of two years and six months, its present worth would be ₹ 1016. The rate percent (in %) of the bill is _____

63. The population of a village is 1000. If the population increases by 10% in the first year, by 20% in the second year and due to migration, if decreases by 5% in the third year, what will be its population after three years? _____

64. A owes B ₹ 1120 payable two years hence. B owes A ₹ 1081.50 payable six month. If they decide to settle their accounts forthwith, 6% per annum as the rate of interest, then who should pay to whom and how much?

(a) A to B, ₹ 70 (b) A to B, ₹ 50 (c) B to A, ₹ 70 (d) B to A, ₹ 50

65. A cash payment that will settle a bill for 250 chairs at ₹ 50 per chair less 20% and 15% with a further discount of 5% on cash payment (in ₹) is _____

66. What percent (in %) profit would be if 34% of cost price is 26% of the selling price? _____

67. Anu owes Babita ₹ 1573 payable one year and six months hence. Babita owes Anu ₹ 1444.50, payable six month hence. If they decide to settle their accounts forthwith, keeping 14% as the rate of interest, then who should pay and how much?

(a) Anu, ₹ 28.50 (b) Babita, ₹ 37.50 (c) Anu, ₹ 50 (d) Babita, ₹ 50

68. A tree, having growth rate of 30% per annum, was planted three years ago. If at present, the height of the tree is 670 cm, what it's height (in cm) when the tree was planted? _____

69. An item is listed at ₹ 65. A customer bought this item for ₹ 56.16 which two successive discounts of which one is 10%. The other discount of this discount scheme that was allowed by the shopkeeper is _____%.

70. A sum was put at simple interest at a certain rate for three years. If it had been put at 1% higher rate, it would have fetched ₹ 5100 more. The sum is ₹ _____$\times 10^4$.

71. Sanjay invests equal amount of money one at 10% per annum compound interest payable half yearly and the second at a x% per annum compound interest payable yearly. If he gets equal amounts after three years, what is the value of the x? _____

72. ₹ 841 is divided between Shyam and Ram, such that Shyam's share at the end of nune years is equal to Ram's share at the end of eleven years, compounded annually at the rate of 5%. The share of Shyam is ₹ _____.

73. A person bought two shirts for ₹ 2200. He sells one at 5% loss and the other at 6% profit and thus on the whole he neither gains nor loses. Find the cost price (in ₹) of that shirt whose cost is more than the other one. _____

74. Arun borrowed a certain sum of money for two years at 8% per annum on simple interest and

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immediately lent it to Amit but at compound interest and gained by ₹ 16. What amount (in ₹) did Arun borrow? _____

75. A man wants to sell his laptop. There are two offers, one at ₹ 12000 cash and other at a credit of ₹ 12880 to be paid after 8 months, money being at 18% per annum. Which one is the better offer?

(a) ₹ 12000 in cash (b) ₹ 12880 at credit
(c) No difference between both offers (d) Cannot be predicted

76. A tradesman gives 4% discount on the marked price and 1 article free with every 15 articles bought and still gains 35%. About how much percentage (in %), the marked price is more than the cost price? _____

77. An article is sold at a profit of 10%. If it had been sold for ₹ 40 less, there would have been a loss of 10%. What was the cost price (in ₹)? _____

78. A village has a population of 6800, which is decreasing at the rate of 120 per year. Another village has a population of 4200, which is increasing at the rate of 80 per year. In how many months will the population of the two villages be equal? _____

79. On selling an item 'A' at 5% loss and another item 'B' at 15% gain, Kiran gains ₹ 7. If she sells the item 'A' at 5% gain and item 'B' at 10% gain, she gains ₹ 13. The actual price of the item 'B' is ₹ _____.

80. If 7% of the sale price of an item is equivalent to 8% of its cost price and 9% of its sale price exceeds 10% of its cost price by ₹ 1, then what is the cost price (in ₹) of the article? _____

81. A computer is available for ₹ 39000 cash or ₹ 17000 as cash down payment followed by five monthly instalments of ₹ 4800 each. What is the rate of interest (in %) per annum under the instalment plant? _____

82. Two equal sums of money were invested, one at 4% and the other at 4.5%. At the end of seven years, the simple interest received from the latter exceeds that received from the former by ₹ 31.50. Each sum was ₹ _____.

83. Two items were sold for ₹ 100 each, gaining 10% on one and losing 10% on the other. The gain or loss percentage in the whole transaction is

(a) No loss or gain (b) 1% gain (c) 1% loss (d) 10% gain

84. The sale price of an item including the sales tax is ₹ 616. The rate of sales tax is 10%. If the shopkeeper has made a profit of 12%, then what is the cost price (in ₹) of an item? _____

85. If selling price doubles, the profit becomes tripled. Find the profit percent (in %).

86. Arun goes to a shop to but a shirt costing ₹ 2568. The rate of sales tax is 7%. He requested the shopkeeper to reduce the price of the shirt to such an extent that he has to pay ₹ 2568, inclusive of sales tax. Find the reduction (in ₹) needed in the price of the shirt. _____

87. A sum of money becomes eight times in three years, if the rate is compounded annually. In how much time (in months) the same amount at the same compound interest rate will become sixteen times? _____

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Answers

Answer Keys: Exercise: 6.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	a	57	1000	14	c	350	c	b	360	7	c	c	a	60
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
400	270	a	366	70	5	c	2	25	b	b	360	3	3	0
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
40	4	24	160	729	2400	320	70	9	3	d	72	d	b	c
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
45	b	900	18	96	8	22	88	b	80	6	a	c	70	d
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
56	6600	4	25	a	60	25	8	48	140	a	c	18	3250	c
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
b	c	b	100	1250	3	c	16	15	c	144	90	c	a	630
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
d	14	c	a	864	420	3	16	230	a	15	616	223	d	b
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
b	25	b	24	2	b	75	73	9.09	320	800	10	50	16.67	5400

Answer Keys: Exercise: 6.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	a	12.5	3.5	b	50	3.8	2.5	4	0.8	3200	184	20	6	1500
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
2000	b	b	240	2000	12.5	10	a	8	1.2	12	c	900	93	1750
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
2	80	2500	31	550	33.33	8.33	10	37	32	25	25	8000	2000	450
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
20	16	700	10	800	405	70	121	20	200	500	500	640	9200	1025
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
90	10	1254	d	8075	30.77	d	305	4	17	10.25	441	1200	2500	a
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**			
50	200	156	80	350	38.71	900	c	500	100	168	48			

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Chapter 7 : Numbers – III

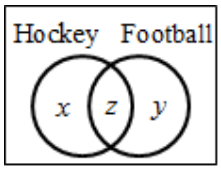
7.1 Set Theory

The theory section for 'Set theory' was already covered in section 2.1 of Engineering Mathematics section. Let us consider some examples:

Example [GA-2010 (1 mark)]: 25 persons are in a room. 15 of them play hockey. 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is:

(a) 2 (b) 17 (c) 13 (d) 3

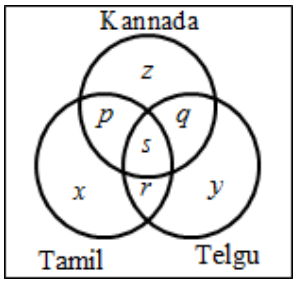
Solution (d): Let x, y and z be the number of players who play only hockey, only football and both hockey & football, respectively. Let n be the number of persons who do not play neither hockey nor football. So from the Venn diagram we have: $x+z=15$ …(i); $y+z=17$ …(ii); $z=10$ …(iii); $x+y+z+n=25$ …(iv). From (i) and (iii), we have $x=5$; from (ii) and (iii), we have $y=7$; so from (iv), we have $5+7+10+n=25\Rightarrow n=3$



Example [GA-2010 (2 marks)]: A gathering of 50 linguists discovered that 4 knew Kannada, Telugu and Tamil, 7 knew only Telugu and Tamil, 5 knew only Kannada and Tamil, 6 knew only Telugu and Kannada. If the number of linguists who knew Tamil is 24 and those who knew Kannada is also 24, how many linguists knew only Telugu?

(a) 9 (b) 10 (c) 11 (d) 8

Solution (c): Let x,y,z,p,q,r,s are the number of linguists who knew only Tamil, only Telgu, only Kannada, both Tamil and Kannada but not Telgu, both Kannada and Telgu but not Tamil, both Tamil and Telgu but not Kannada, all Tamil, Telgu and Kannada. So from the Venn diagram we have: $s=4$ …(i); $r=7$ …(ii); $p=5$ …(iii); $q=6$ …(iv); $x+p+s+r=24\Rightarrow x=8$ …(v); $z+p+s+q=24\Rightarrow z=9$ … (vi); $x+y+z+p+q+r+s=50$ …(vii). We have to find the number of linguists who knew only Telgu i.e., we have to find the value of y. So putting all the values in (viii) we get $8+y+9+5+6+7+4=50\Rightarrow y=11$.



Alternate Method: Let, $K=$ set of linguists who know Kannada; $Te=$ set of linguists who know Telugu; $Ta=$ set of linguists who know Tamil. According to question, $n(K\cup Te\cup Ta)=50$; $n(K\cap Te\cap Ta)=4$; $n(Te\cap Ta)=7+4=11$; $n(K\cap Ta)=5+4=9$; $n(Te\cap K)=6+4=10$; $n(Ta)=24$; $n(K)=24$; $n(Te)=x$; Thus,

$n(K\cup Te\cup Ta)=n(Ta)+n(K)+n(Te)-n(Te\cap Ta)-n(K\cap Ta)-n(Te\cap K)+n(K\cap Te\cap Ta)$

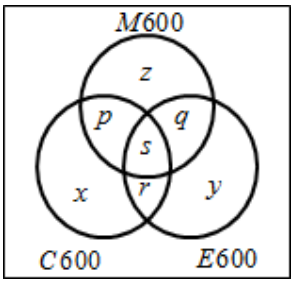
$\Rightarrow 50=24+24+x-11-9-10+4\Rightarrow x=28$. So the number of linguists who knew only Telugu is $28-7-4-6=11$.

Example [GA-2011 (2 marks)]: In a class of 300 students in an M.Tech programme, each student is required to take at least one subject from the following three: M600: Advanced Engineering Mathematics; C600: Computational Methods for Engineers; E600: Experimental Techniques for Engineers. The registration data for the M.Tech class shows that 100 students have taken M600, 200 students have taken C600, and 60 students have taken E600. What is the maximum possible number of students in the class who have taken all the above three subjects?

(a) 20 (b) 30 (c) 40 (d) 50

Solution (b): Let x,y,z,p,q,r,s are the number of students who registered for only C600, only E600, only M600, both C600 and M600 but not E600, both M600 and E600 but not C600, both C600 and E600 but not M600, all C600, M600 and E600. So from the Venn diagram we have:

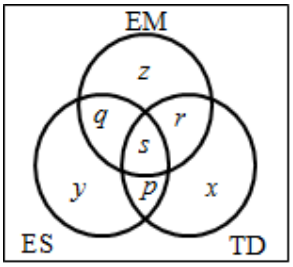
$z+p+s+q=100$ …(i); $x+p+s+r=200$ …(ii); $y+q+s+r=60$ …(iii); $x+y+z+p+q+r+s=300$ …(iv). Now $(i)+(ii)+(iii)-(iv) \Rightarrow (p+q+r)+2s=60$ …(v). From (v) we can judge that s will have maximum value if and only if $(p+q+r)$ have its minimum value. As p,q,r are non-negative numbers so we have least value of $(p+q+r)$ when $p=q=r=0$, i.e. no student is registered for only 2 subjects. Thus we have maximum possible number of students in the class who have taken all three subjects if $p=q=r=0$ in (v), i.e. $2s=60 \Rightarrow s=30$.



Example [GA-2015 (2 marks)]: There are 16 teachers who can teach Thermodynamics (TD), 11 who can teach Electrical Sciences (ES), and 5 who can teach both TD and Engineering Mechanics (EM). There are a total of 40 teachers. 6 cannot teach any of the three subjects, i.e. EM, ES or TD. 6 can teach only ES. 4 can teach all three subjects, i.e. EM, ES and TD. 4 can teach ES and TD. How many can teach both ES and EM but not TD?

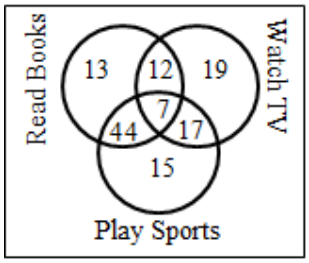
(a) 1 (b) 2 (c) 3 (d) 4

Solution (a): Let x,y,z,p,q,r,s are the number of teachers who teaches only TD, only ES, only EM, both TD and ES but not EM, both ES and EM but not TD, both EM and TD but not ES, all ES, TD and EM. So from the Venn diagram we have: $x+p+s+r=16$ …(i); $y+p+s+q=11$ …(ii); $r+s=5$ …(iii); as there are a total of $(40-6)=34$ teachers so $x+y+z+p+q+r+s=34$ …(iv); $y=6$ …(v); $s=4$ …(vi); $p+s=4$. …(vii). We have to find the value of q. (vi) and (vii) $\Rightarrow p=0$; (ii) $\Rightarrow 6+0+4+q=11 \Rightarrow q=1$.



Example [GA-2016 (2 marks)]: The Venn diagram shows the preference of the student population for leisure activities. From the data given, the number of students who like to read books or play sports is _____

(a) 44
(b) 51
(c) 79
(d) 108

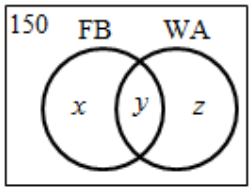


Solution (d): From the given Venn-diagram the total number of students who like to read books or play sports is $13+12+7+44+17+15=108$.

Example [GA-2016 (2 marks)]: Among 150 faculty members in an institute, 55 are connected with each other through Facebook® and 85 are connected through WhatsApp®. 30 faculty members do not have Facebook® or WhatsApp® accounts. The number of faculty members connected only through Facebook® accounts is _____.

(a) 35 (b) 45 (c) 65 (d) 90

Solution (a): From the given Venn-diagram, 55 are connected with each other through Facebook® (FB), i.e. $x+y=55$ …(i); 85 are connected through WhatsApp® (WA), i.e. $y+z=85$ …(ii); 30 faculty members do not have FB or WA accounts, $150-(x+y+z)=30 \Rightarrow x+y+z=120$ …(iii). From (iii) and (i), we have $z=120-55=65$ …(iv). From (iv) and (ii), we have $y=85-65=20$ …(v). From (v) and (i), we have $x=55-20=35$. Hence the number of faculty members connected only through FB is $x=35$. Thus option (a) is correct.



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Please note that the exercise on 'Set Theory' is already given section 2.1 of 'Engineering Mathematics' section, as it is a common topic on Engineering Mathematics and General Aptitude.

7.2 Sequence, Series and Progression

The theory section for 'Sequence, Series and Progression' was already covered in section 0.4 of Engineering Mathematics section. Let us consider some examples:

Example [GA-2010 (2 marks)]: Consider the series $\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\frac{1}{8}+\frac{1}{9}-\frac{1}{16}+\frac{1}{32}+\frac{1}{27}-\frac{1}{64}+\cdots$. The sum of the infinite series above is:

(a) ∞ (b) $5/6$ (c) $1/2$ (d) 0

Solution (b): The given series $S=\left(\frac{1}{2}+\frac{1}{8}+\frac{1}{32}\cdots\right)+\left(\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\cdots\right)-\left(\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+\cdots\right)$

$\Rightarrow S=\left(\frac{1}{2^1}+\frac{1}{2^3}+\frac{1}{2^5}\cdots\right)+\left(\frac{1}{3^1}+\frac{1}{3^2}+\frac{1}{3^3}+\cdots\right)-\left(\frac{1}{4^1}+\frac{1}{4^2}+\frac{1}{4^3}+\cdots\right)$. As we have infinite geometric series so $S=\frac{1/2}{1-1/2^2}+\frac{1/3}{1-1/3}-\frac{1/4}{1-1/4}=\frac{2}{3}+\frac{1}{2}-\frac{1}{3}=\frac{5}{6}$

Example [GA-2011 (2 marks)]: The of n terms of the series $4+44+444+\cdots$ is

(a) $(4/81)[10^{n+1}-9n-1]$ (b) $(4/81)[10^{n-1}-9n-1]$

(c) $(4/81)[10^{n+1}-9n-10]$ (d) $(4/81)[10^{n}-9n-10]$

Solution (c): Let $S=4+44+444+\cdots=4(1+11+111+\cdots)=(4/9)(9+99+999+\cdots)$

$\Rightarrow S=\frac{4}{9}(10-1+10^2-1+10^3-1+\cdots)=\frac{4}{9}\{(10+10^2+10^3+\cdots)-n\}=\frac{4}{9}\left\{\frac{10(10^n-1)}{10-1}-n\right\}$

$\Rightarrow S=\frac{4}{9}\left\{\frac{10(10^n-1)-9n}{9}\right\}=\frac{4}{81}\{10^{n+1}-10-9n\}$.

Alternative method: Choosing $n=1$, we get the sum $S=4$. So putting $n=1$ in each option, we get $S=44/9$ from option (a); $S=-4/9$ from option (b); $S=4$ from option (c); $S=0$ from option (d). Thus options (a), (b) and (d) are not correct. Note that if we get more than one option seems to be correct by putting $n=1$ then we have to check for these options by putting $n=2$.

Example [GA-2012 (1 mark)]: The arithmetic mean of five different natural numbers is 12. The largest possible value among the numbers is

(a) 12 (b) 40 (c) 50 (d) 60

Solution (c): Let x_1,x_2,x_3,x_4,x_5 are five different natural numbers, then from the given data we have $\frac{x_1+x_2+x_3+x_4+x_5}{5}=12\Rightarrow x_1+x_2+x_3+x_4+x_5=60$. Let x_5 be the largest number, so $x_5=60-(x_1+x_2+x_3+x_4)$. As x_1,x_2,x_3,x_4 are different natural numbers, so for maximizing x_5, we have to minimizing x_1,x_2,x_3,x_4; the only possible different values of x_1,x_2,x_3,x_4 are $1,2,3,4$, respectively. Thus $x_5=60-(1+2+3+4)=50$.

Example [GA-2013 (1 mark)]: What will be the maximum sum of $44,42,40,\cdots$?

(a) 502 (b) 504 (c) 506 (d) 500

Solution (c): As the given terms are decreasing so we have the maximum sum of the given series if the last term is 0. Thus we have $44,42,40,\cdots,0$; for number of terms in the given sequence we have

an AP whose first term $a=44$, common difference $d=-2$, last term $l=0$ $\Rightarrow 0=44+(n-1)(-2)\Rightarrow n=23$. Now $S=(n/2)(a+l)=(23/2)\{44+0\}=506$.

Example [GA-2013 (2 marks)]: Find the sum to n terms of the series $10+84+734+\cdots$

(a) $\frac{9(9^n+1)}{10}+1$ (b) $\frac{9(9^n-1)}{8}+1$ (c) $\frac{9(9^n-1)}{8}+n$ (d) $\frac{9(9^n-1)}{8}+n^2$

Solution (d): The given sum of series can be written as: $S=(9+1)+(9^2+3)+(9^3+5)+\cdots$

$$\Rightarrow S=(9+9^2+9^3+\cdots)+(1+3+5+\cdots)=\frac{9(9^n-1)}{9-1}+\frac{n}{2}\{2\times1+(n-1)2\}=\frac{9(9^n-1)}{8}+n^2.$$

Alternative method: By putting $n=1$ we have $S=10$. We get $S=10$ from all options. Now by putting $n=2$, the sum must be $S=10+84=94$; so we get $S=74.8$ from option (a); $S=91$ from option (b); $S=92$ from option (c); $S=94$ from option (d); so option (d) is correct.

Example [GA-2013 (2 marks)]: Find the sum of the expression $\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\cdots+\frac{1}{\sqrt{80}+\sqrt{81}}$.

(a) 7 (b) 8 (c) 9 (d) 10

Solution (b): Using the relation $(a-b)=(\sqrt{a}-\sqrt{b})(\sqrt{a}+\sqrt{b})$. The given sum can be written as:

$$S=\frac{\sqrt{1}-\sqrt{2}}{1-2}+\frac{\sqrt{2}-\sqrt{3}}{2-3}+\frac{\sqrt{3}-\sqrt{4}}{3-4}+\cdots+\frac{\sqrt{80}-\sqrt{81}}{80-81}$$

$$\Rightarrow S=\sqrt{2}-\sqrt{1}+\sqrt{3}-\sqrt{2}+\sqrt{4}-\sqrt{3}+\cdots+\sqrt{81}-\sqrt{80}=\sqrt{81}-\sqrt{1}=8.$$

Example [GA-2014 (1 mark)]: In a sequence of 12 consecutive odd numbers, the sum of the first 5 numbers is 425. What is the sum of the last 5 numbers in the sequence?

Solution: Let x be the smallest odd number, so twelve consecutive odd numbers are $x,(x+2),(x+4),(x+6),(x+8),(x+10),(x+12),(x+14),(x+16),(x+18),(x+20),(x+22)$. The sum of the first 5 numbers is 425, i.e. $x+x+2+x+4+x+6+x+8=425\Rightarrow 5x+20=425\Rightarrow x=81$. Now sum of last 5 numbers in the sequence will be $S=x+14+x+16+x+18+x+20+x+22=5x+90=5\times81+90=495$.

Example [GA-2014 (2 marks)]: The sum of eight consecutive odd numbers is 656. The average of four consecutive even numbers is 87. What is the sum of the smallest odd number and second largest even number? _____

Solution: Let x be the smallest odd number, so eight consecutive odd numbers are $x,(x+2),(x+4),(x+6),(x+8),(x+10),(x+12),(x+14)$. Let y be the smallest even number, so four consecutive even numbers are $y,(y+2),(y+4),(y+6)$. Thus from the given data, we have $x+(x+2)+(x+4)+(x+6)+(x+8)+(x+10)+(x+12)+(x+14)=656\Rightarrow x=75$; and $\{y+(y+2)+(y+4)+(y+6)\}/4=87\Rightarrow y=84$. So smallest odd number is $x=75$ and second largest even number is $y+4=88$. Thus the required sum is $75+88=163$.

Example [GA-2014 (1 mark)]: What is the average of all multiples of 10 from 2 to 198?

(a) 90 (b) 100 (c) 110 (d) 120

Solution (b): As all the multiples of 10 from 2 to 198 are $\{10,20,30,\cdots190\}$ which are total 19 terms whose sum is $=\frac{19}{2}\{2\times10+(19-1)10\}=1900$. So, average is $=\frac{10+20+30+\cdots190}{19}=\frac{1900}{19}=100$.

Example [GA-2015 (2 marks)]: If the list of letters P, R, S, T, U is an arithmetic sequence, which of the following are also in arithmetic sequence?

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I. 2P, 2R, 2S, 2T, 2U II. P – 3, R – 3, S – 3, T – 3, U – 3 III. P^2, R^2, S^2, T^2, U^2
(a) I only (b) I and II (c) II and III (d) I and III
Solution (c): We know that by adding, subtracting, multiplication or division of a constant in each terms of an AP, the new sequence remains in an AP. So statements I and II are correct.

Please note that the exercise on 'Sequence, Series and Progression' is already given in chapter 0 of section 0.2 of 'Engineering Mathematics' section, as it is a common topic on Engineering Mathematics and General Aptitude.

7.3 Next Number, Missing Number, Odd Number in a Sequence

In this type of questions a sequence of numbers is provided, which are called terms of the sequence. All the terms in the sequence follow a certain pattern throughout the series. You are required to recognise this pattern and either complete the series with most suitable alternative or find out the wrong term in the series. Let us consider some examples:

Example [GA-2014 (1 mark)]: Which number does not belong in the series below? $2, 5, 10, 17, 26, 37, 50, 64$.
(a) 17 (b) 37 (c) 64 (d) 26
Solution (c): As by subtracting a term by its preceding term we find every subtraction exceeds by two than its preceding subtraction; but when we subtract 50 from 64, the result not exceeds by two than its preceding subtraction. So '64' does not belong to the given series.

2	5	10	17	26	37	50	64	Given sequence
	3	5	7	9	11	13	14	Subtraction

Example [GA-2014 (1 mark)]: What is the next number in the series? $12, 35, 81, 173, 357, \_\_$.
Solution: As by subtracting a term by its preceding term we find every subtraction is two times than its preceding subtraction; let x be the required number and y be the result of subtraction. So $y = 2 \times 184 = 368$. We get $y = 368$ when we subtract 357 from x, i.e. $368 = x - 357 \Rightarrow x = 725$. So answer is 725.

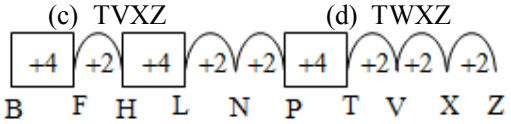
12	35	81	173	357	x	Given sequence
	23	46	92	184	y	Subtraction

Example [GA-2014 (1 mark)]: Fill in the missing number in the series. $2, 3, 6, 15, \_\_\_, 157.5, 630$.
Solution: As by dividing a term by its preceding term we find every division exceeds by 0.5 from its preceding division. Let x be the required number, so when x is divides by 15 we must get 3; so $x/15 = 2 \Rightarrow x = 45$. We can check $157.5/45 = 3.5$. So answers is 45.

2	3	6	15	x	157.5	630	Given sequence
	1.5	2	2.5	3	3.5	4	Division

Example [GA-2014 (1 mark)]: The next term in the series 81, 54, 36, 24, ⋯ is _____.
Solution: As by dividing a term by its exceeding term we find every division is 1.5. So let x be the required number, thus when 24 is divided by x we must get 1.5, i.e. $24/x = 1.5 \Rightarrow x = 16$. So required answer is 16.

Example [GA-2016 (2 marks)]: Find the missing sequence in the letter series. **B, FH, LNP, _ _ _ _.**
(a) SUWY (b) TUVW (c) TVXZ (d) TWXZ
Solution (c): The following letter series is of the following order



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Exercise: 7.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	What are the next 2 numbers in the pattern $2, 7, -1, 10, -4, 13, \_\_, \_\_$? (a) $-7, 16$ (b) $-8, 15$ (c) $-7, 15$ (d) $-8, 16$
2.	What is the next term of the sequence: 120, 99, 80, 63, 48, 35, _____.
3.	What is the next term of the sequence: 2, 5, 26, _____.
4.	What is the next term of the sequence: 2, 6, 18, 54, _____.
5.	What is the next term of the sequence: 1, 1, 4, 8, 9, 27, 16, 64, _____.
6.	What is the next term of the sequence: 1, 2, 3, 6, 9, 18, 27, _____.
7.	What is the next term of the sequence: 6, 13, 25, 51, 101, 203, _____.
8.	What is the next term of the sequence: 5, 6, 9, 15, 25, _____.
9.	What is the next term of the sequence: 1, 3, 4, 8, 15, 27, 50, _____.
10.	What is the next term of the sequence: 3, 4, 7, 7, 13, 13, 21, 22, 31, 34, 43, _____.
11.	What is the next term of the sequence: 198, 194, 185, 169, 144, _____.
12.	What is the next term of the sequence: 2, 3, 5, 7, 11, 13, _____.
13.	What is the next term of the sequence: 2, 3, 3, 5, 10, 13, 39, 43, 172, _____.
14.	What is the next term of the sequence: 9, 27, 31, 155, 161, _____.
15.	What is the next term of the sequence: 2, 1, 2, 4, 4, 5, 6, 7, 8, 8, 10, 11, _____.
16.	What is the next term of the sequence: 3, 15, 35, 63, 99, _____.
17.	What is the missing term of the sequence: 48, 24, 96, 48, _____, 96, 384.
18.	What is the missing term of the sequence: 563, 647, _____, 815, 143.
19.	What is the missing term of the sequence: 13, 35, 57, 79, _____, 1113, 1315.
20.	What is the missing term of the sequence: 24, 46, _____, 810, 1012, 1214.
21.	What is the missing term of the sequence: 240, _____, 120, 40, 10, 2.
22.	What is the missing term of the sequence: 3, 9, _____, 21, 27.
23.	What is the missing term of the sequence: 28, 33, 31, _____, 34, 39.
24.	What is the missing term of the sequence: 1, 9, _____, 49, 81.
25.	What is the missing term of the sequence: 2, 2, 5, 13, _____, 52, 87.
26.	What is the missing term of the sequence: 1, 5, 14, 30, _____, 91, 140, 204.
27.	What is the missing term of the sequence: 20, 20, 19, 16, 17, 13, _____, 11, 10, 10.
28.	What is the missing term of the sequence: 24, 60, 120, 210, _____, 498.
29.	What is the missing term of the sequence: 625, 5, 125, 25, _____, 125, 5.
30.	What is the missing term of the sequence: 11, 10, 101, _____, 1001, 1000, 10001
31.	What is the missing term of the sequence: 2, 7, 27, 107, _____, 1707.
32.	Which of the following cannot be part of the sequence: 2, 6, 18, 54, ⋯ (a) 486 (b) 1312 (c) 1458 (d) 4374
33.	Which of the following cannot be part of the sequence: 5, 10, 20, 40, ⋯ (a) 160 (b) 2560 (c) 650 (d) 1280
34.	Which of the following cannot be part of the sequence: 1, 8, 27, 64, 125, ⋯ (a) 169 (b) 512 (c) 729 (d) 1000
35.	Which of the following cannot be part of the sequence: 3, 9, 15, 21, ⋯ (a) 123 (b) 153 (c) 189 (d) 245
36.	Which of the following cannot be part of the sequence: 10, 17, 24, 31, 38, ⋯ (a) 48 (b) 346 (c) 574 (d) 1003
37.	Which of the following cannot be part of the sequence: 1, 1, 2, 6, 24, ⋯ (a) 5040 (b) 540 (c) 120 (d) 720
38.	Which of the following cannot be part of the sequence: 2, 15, 4, 12, 6, 7, ⋯ (a) 13 (b) 14 (c) 0 (d) 8
39.	Which of the following cannot be part of the sequence: 40, 36, 34, 30, 28, ⋯ (a) 22 (b) 14 (c) 6 (d) 16
40.	Which of the following cannot be part of the sequence: 20, 22, 21, 23, 22, 24, 23, ⋯

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	(a) 26	(b) 27	(c) 28	(d) 16
41.	Which of the following cannot be part of the sequence: 53, 53, 40, 40, 27, 27, ⋯			
	(a) 14	(b) 1	(c) –25	(d) 12
42.	Which of the following cannot be part of the sequence: 3, 5, 9, 17, 33, 65, ⋯			
	(a) 257	(b) 513	(c) 129	(d) 960
43.	Which of the following cannot be part of the sequence: 8, 22, 8, 28, 8, 34, 8, 40, 8, ⋯			
	(a) 52	(b) 84	(c) 64	(d) 76
44.	The odd one in the given sequence is: 6, 15, 35, 77, 165, 221, 323, ⋯			
	(a) 35	(b) 77	(c) 165	(d) 221
45.	The odd one in the given sequence is: 121, 143, 164, 187, 209, 231, ⋯			
	(a) 143	(b) 164	(c) 187	(d) 209
46.	The odd one in the given sequence is: 8, 13, 21, 32, 46, 63, 84, ⋯			
	(a) 21	(b) 32	(c) 63	(d) 84
47.	The odd one in the given sequence is: 1, 2, 6, 8, 16, 32, 64, 128, ⋯			
	(a) 6	(b) 8	(c) 32	(d) 128
48.	The odd one in the given sequence is: 3, 4, 10, 33, 136, 684, 4116, ⋯			
	(a) 10	(b) 33	(c) 136	(d) 684
49.	The odd one in the given sequence is: 105, 85, 60, 30, –5, –40, –90, ⋯			
	(a) 60	(b) 30	(c) –5	(d) –40
50.	The odd one in the given sequence is: 2, 5, 10, 16, 26, 37, 50, 65, ⋯			
	(a) 10	(b) 16	(c) 26	(d) 37
51.	The odd one in the given sequence is: 125, 126, 124, 127, 123, 130, ⋯			
	(a) 124	(b) 127	(c) 123	(d) 130
52.	The odd one in the given sequence is: 1, 2, 3, 4, 8, 32, 256, 8192, ⋯			
	(a) 3	(b) 4	(c) 8	(d) 256
53.	The odd one in the given sequence is: 1, 3, 12, 27, 49, ⋯			
	(a) 3	(b) 12	(c) 27	(d) 49
54.	The odd one in the given sequence is: 15, 16, 20, 28, 45, 70, ⋯			
	(a) 16	(b) 20	(c) 28	(d) 45
55.	The odd one in the given sequence is: 3, 9, 27, 4, 15, 64, 5, 25, 125, ⋯			
	(a) 27	(b) 4	(c) 15	(d) 64
56.	The odd one in the given sequence is: 2, 6, 25, 97, 285, 568, 567, ⋯			
	(a) 6	(b) 25	(c) 97	(d) 285
57.	The odd one in the given sequence is: 3, 2, 8, 12, 16, 22, 18, 32, 23, 42, ⋯			
	(a) 8	(b) 16	(c) 22	(d) 18
58.	The odd one in the given sequence is: 56, 58, 62, 72, 86, 118, 182, ⋯			
	(a) 58	(b) 72	(c) 118	(d) 182
59.	The odd one in the given sequence is: 1, 5, 5, 9, 7, 11, 11, 14, 13, 17, ⋯			
	(a) 11	(b) 14	(c) 13	(d) 17
60.	The odd one in the given sequence is: 25, 49, 80, 121, 169, 225, ⋯			
	(a) 80	(b) 121	(c) 169	(d) 225
61.	The odd one in the given sequence is: 1, 3, 10, 21, 64, 126, 388, 777, ⋯			
	(a) 10	(b) 64	(c) 126	(d) 777
62.	The odd one in the given sequence is: 2, 3, 4, 4, 6, 8, 8, 12, 18, ⋯			
	(a) 3	(b) 6	(c) 12	(d) 18
63.	The odd one in the given sequence is: 11, 5, 20, 12, 38, 28, 74, 54, ⋯			
	(a) 38	(b) 28	(c) 74	(d) 54
64.	The odd one in the given sequence is: 5, 24, 61, 125, 213, 340, 509, ⋯			
	(a) 24	(b) 61	(c) 125	(d) 213
65.	The odd one in the given sequence is: 380, 188, 92, 44, 20, 8, 6, ⋯			
	(a) 188	(b) 44	(c) 20	(d) 6
66.	The odd one in the given sequence is: 10, 26, 74, 220, 650, 1946, ⋯			
	(a) 74	(b) 220	(c) 650	(d) 1946
67.	The odd one in the given sequence is: 46080, 3840, 384, 12, 8, 2, 1, ⋯			

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	(a) 12	(b) 8	(c) 2	(d) 1
68.	The odd one in the given sequence is: 0, 2, 3, 5, 8, 10, 15, 17, 24, 26, 34, ⋯			
	(a) 8	(b) 15	(c) 24	(d) 34
69.	The odd one in the given sequence is: 325, 259, 204, 160, 127, 105, 96, ⋯			
	(a) 325	(b) 204	(c) 127	(d) 96
70.	The odd one in the given sequence is: 93, 309, 434, 500, 525, 533, ⋯			
	(a) 309	(b) 434	(c) 500	(d) 525
71.	The odd one in the given sequence is: 2, 12, 36, 80, 160, 252, ⋯			
	(a) 12	(b) 36	(c) 160	(d) 252

7.4 Next, Missing, Odd Alphabet or Alphabet and Number in a Sequence

In this type of questions a sequence of English alphabets (either individual letter series or a sequence of combination of letters) or numeral-alphabet is provided, which are usually called terms of the sequence. All the terms in the sequence follow a certain pattern throughout the series. You are required to recognise this pattern and either complete the series with most suitable alternative or find out the wrong term in the series. The questions based on English alphabets or Numeral-Alphabets generally harp on the relative positions of alphabets. Therefore, you should remember the position (number) of each alphabet both from left to right and from right to left. It is to be noted that it is not necessary the alphabet 'A' is always numbered as '1', sometimes, say, the alphabet 'P' is numbered as '1', then 'Q' is numbered as '2' and so 'Z' is numbered as '11' and then 'A' is numbered as '12' and so on. Thus you have to identify the correct pattern before answering the question. Let us consider some examples:

Example [GA-2010 (2 marks)]: Given the sequence A, B, B, C, C, C, D, D, D, D, … etc., that is one A, two Bs, three Cs, four Ds, five Es and so on, the 240th letter in the sequence will be:
(a) V (b) U (c) T (d) W
Solution (a): For finding the 240th letter in the given sequence, we have to find the total number of terms whose sum is 240. As our sequence $1, 2, 3, 4, \cdots$, have 1st term $a = 1$, common difference $d = 1$.
$\Rightarrow S_n = (n/2)\big(2a + (n-1)d\big) \Rightarrow 240 = (n/2)\big(2 + (n-1)\big) \Rightarrow n^2 + n - 480 = 0 \Rightarrow n = -22.41, 21.41$. As 21st letter in alphabets is U and 22nd is V. So we have 1 A, 2 Bs, 3 Cs, 4 Ds, ⋯, 21 Us, 22 Vs. We can see that all Us lie before the 240th letter. As n cannot be negative and n must be a least integer greater that 21.41, thus the 240th letter in the sequence will be the 22nd letter of the alphabets, i.e., V.

Example [GA-2012 (2 marks)]: Given the sequence of terms, AD CG FK JP, the next term is
(a) OV (b) OW (c) PV (d) PW
Solution (a): We note that first letter of the elements of the given sequence is A, C, F, J which are at 1st, 3rd, 6th, 10th position of letter of alphabets; the difference of a position from its preceding position is 2, 3, 4, so the difference between the position of next alphabet and the 10th position must be 5, i.e. the next alphabet is at (10+5)th position or 15th position, which is the letter 'O'. Similar argument also holds for the second letter of the given sequence and so the second letter is 22st letter of alphabet, which is V. So the required term is OV.

Example [GA-2014 (2 marks)]: Find the next term in the sequence: $7G, 11K, 13M, \_\_\_$.
(a) $15Q$ (b) $17Q$ (c) $15P$ (d) $17P$
Solution (b): Note that the alphabets given in the sequence is occurring exactly the same position which is associated with the alphabet, for e.g. G comes at 7th position in alphabets from A to Z. As $11 = 7 + 4$, $13 = 11 + 2$. Now it seems that the number is decreasing by 2 so if we choose the next number as $x = 13 + 0 = 13$ which is not in the given options so this method is of no use. If we decide that the difference between a number and its preceding number takes the value alternatively then the next number will be $x = 13 + 4 = 17$; also the 17th alphabet is Q. So the next term in the given sequence is $17Q$.

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Example [GA-2014 (2 marks)]: Find the next term in the sequence: 13M, 17Q, 19S, ___.
(a) 21W (b) 21V (c) 23W (d) 23V
Solution (c): From the same arguments from previous question we find that the next term of the given sequence is 23W.

Example [GA-2014 (2 marks)]: Find the odd one from the following group:
W,E,K,O I,Q,W,A F,N,T,X N,V,B,D
(a) W,E,K,O (b) I,Q,W,A (c) F,N,T,X (d) N,V,B,D
Solution (d): Writing the alphabets two times i.e., A, B, C, ⋯, Z, A, B, C, ⋯, Z. For option (a), if W comes at 1st position in the first set of alphabets then E comes at the 9th position, K comes at the 15th position, O comes at the 19th position in the second set of alphabet. Similar argument can also be given for other options. The result is summarised as:
option (a): $\underset{1}{W}\,\underset{9}{E}\,\underset{15}{K}\,\underset{19}{O}$; option (b): $\underset{1}{I}\,\underset{9}{Q}\,\underset{15}{W}\,\underset{19}{A}$; option (c): $\underset{1}{F}\,\underset{9}{N}\,\underset{15}{T}\,\underset{19}{X}$; option (d): $\underset{1}{N}\,\underset{9}{V}\,\underset{15}{B}\,\underset{17}{D}$. Thus the odd one in the given group is option (d).
[Similar question was also asked in GA-2014 (2 marks)]

Example [GA-2014 (2 marks)]: Find the odd one in the following group: ALRVX, EPVZB, ITZDF, OYEIK
(a) ALRVX (b) EPVZB (c) ITZDF (d) OYEIK
Solution (d): In option (a): ALRVX, we have only 1 vowel; in option (b): EPVZB, we have only 1 vowel; in option (c): ITZDF, we have only 1 vowel; in option (d) OYEIK, we have 3 vowels. So option (d) is the odd one in the given group.

Example [GA-2015 (1 mark)]: Find the missing sequence in the letter series below: **A, CD, GHI, ?, UVWXY**.
(a) LMN (b) MNO (c) MNOP (d) NOPQ
Solution (c): As the 1st term contains 1 alphabet; 2nd term contains 2 alphabets; 3rd term contains 3 alphabets; so 4th term contains 4 alphabets; 5th term contains 5 alphabets. Now missing alphabets between 1st and 2nd term is B (which is 1 alphabet); between 2nd and 3rd term is EF (which is two alphabets); so between 4th and 3rd terms the missing alphabets is JKL (which is three alphabets); also between 5th and 4th terms the missing alphabets is QRST (which is four alphabets). Thus the required term is all the alphabets between JKL and QRST, i.e. MNOP.

Example [GA-2016 (1 mark)]: The number that least fits this set: (324, 441, 97 and 64) is _____.
(a) 324 (b) 441 (c) 97 (d) 64
Solution (c): The numbers (except 97) in the given set are perfect square. So the number that least fits this set: (324, 441, 97 and 64) is 97.

Example [GA-2016 (1 mark)]: Pick the odd one from the following options.
(a) CADBE (b) JHKIL (c) XVYWZ (d) ONPMQ
Solution (d): In each of the options (a), (b) and (c), the 1st, 3rd, and 5th English alphabets are in increasing order, i.e. C_D_E, J_K_L, X_Y_Z; and 2nd and 4th English alphabets are in increasing order, i.e. _A_B_, _H_I_, _V_W_. But in option (d), the 1st, 3rd, and 5th English alphabets are in increasing order, i.e. O_P_Q; and 2nd and 4th English alphabets are in decreasing order, i.e. _N_M_ hence we have N and M instead of M and N. So option (d) is the odd one from the given options.

Example [GA-2016 (1 mark)]: Pick the odd one out in the following: **13, 23, 33, 43, 53**
(a) 23 (b) 33 (c) 43 (d) 53
Solution (b): All the given numbers except '33' are prime numbers. So '33' is the odd one from the given numbers.

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Exercise: 7.2

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	The next term in the sequence is: Y, W, U, S, Q, _____.			
	(a) N	(b) J	(c) O	(d) M
2.	The next term in the sequence is: A, B, D, G, K, _____.			
	(a) N	(b) O	(c) P	(d) Q
3.	The next term in the sequence is: A, Z, X, B, V, T, C, R, P, _____.			
	(a) C	(b) D	(c) E	(d) F
4.	The next term in the sequence is: R, M, I, F, D, _____.			
	(a) C	(b) D	(c) E	(d) F
5.	The next term in the sequence is: Z, L, X, J, V, H, T, F, R, _____.			
	(a) A	(b) B	(c) C	(d) D
6.	The next term in the sequence is: SCD, TEF, UGH, VIJ, _____.			
	(a) WKL	(b) CMN	(c) UJI	(d) IJT
7.	The next term in the sequence is: FAG, GAF, HAI, IAH, JAK, _____.			
	(a) HAL	(b) KAJ	(c) HAK	(d) JAI
8.	The next term in the sequence is: ELFA, GLHA, ILJA, KLLA, _____.			
	(a) OLPA	(b) KLMA	(c) MLNA	(d) LLMA
9.	The next term in the sequence is: CMM, EOO, GQQ, ISS, _____.			
	(a) GRR	(b) ITT	(c) GSS	(d) KUU
10.	The next term in the sequence is: QPO, NML, KJI, HGF, _____.			
	(a) CAB	(b) GHI	(c) KJL	(d) EDC
11.	The next term in the sequence is: JAK, KBL, LCM, MDN, NEO, _____.			
	(a) OEP	(b) PFO	(c) OFP	(d) PFQ
12.	The next term in the sequence is: BCB, DED, FGF, HIH, JKJ, _____.			
	(a) HJH	(b) LML	(c) HJH	(d) IJI
13.	The next term in the sequence is: BEH, DGJ, FIL, EJO, GLQ, _____.			
	(a) INS	(b) SIN	(c) PRQ	(d) QRP
14.	The next term in the sequence is: APZLT, CQYNR, ERXPP, GSWRN, ITVTL, _____.			
	(a) KUUVJ	(b) JUUVK	(c) KVIJUJ	(d) KUUSJ
15.	The next term in the sequence is: CWE, FQH, RDI, MCO, _____.			
	(a) UFD	(b) XBZ	(c) TGU	(d) FUT
16.	The missing term in the sequence is: J, F, M, A, _____, J, J, A.			
	(a) O	(b) N	(c) M	(d) D
17.	The missing term in the sequence is: PRT, VXZ, BDF, _____, NPR.			
	(a) HJL	(b) UWY	(c) VYA	(d) AXY
18.	The missing term in the sequence is: KPA, LQB, MRC, _____, OTE.			
	(a) TOE	(b) NSD	(c) EOT	(d) IJOT
19.	The missing term in the sequence is: AZA, BYB, _____, DWD.			
	(a) CXC	(b) DXD	(c) DXM	(d) CJM
20.	The missing term in the sequence is: NMO, RQS, _____, ZYA, DCE.			
	(a) BCD	(b) FCH	(c) VUW	(d) WUV
21.	The missing term in the sequence is: CAT, HEN, TIN, _____, HUT			
	(a) PET	(b) PUT	(c) TOP	(d) SIT
22.	The missing term in the sequence is: DCXW, FEVU, _____, JIRQ, LKPO.			
	(a) GHTS	(b) ABYZ	(c) JIRQ	(d) LMRQ
23.	The missing term in the sequence is: BAS, BBR, DCQ, _____, FEO.			
	(a) EBT	(b) DDP	(c) EBR	(d) FCT
24.	The missing term in the sequence is: BAZ, _____, FEX, HGW.			
	(a) CDY	(b) DCX	(c) BAY	(d) DCY
25.	The next term in the sequence is: A, BBB, CCCCC, _____.			
	(a) DDDDDDD	(b) DDDDDD	(c) DDDDDDDD	(d) DDDDD

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26. The next term in the sequence is: A, AC, ACE, _____.
(a) ACEK (b) ACEG (c) ACEF (d) ACEH

27. The next term in the sequence is: Z, ZX, ZXV, _____.
(a) ZXVK (b) ZXVP (c) ZXVT (d) ZXVU

28. The next term in the sequence is: ABC, DEF, IJK, _____.
(a) OPQ (b) TUV (c) XYZ (d) PQR

29. The next term in the sequence is: C, GI, MOQ, _____.
(a) VXZB (b) UWYA (c) XZBD (d) ZCEG

30. The next term in the sequence is: A, H, BG, FD, ABE, BAF, _____.
(a) ABEO (b) FCHJ (c) EAB (d) CDC

31. The next term in the sequence is: B, I, BH, FE, ABF, _____.
(a) CDD (b) BAG (c) CHG (d) GAN

32. The next term in the sequence is: B, D, H, AF, CB, FD, ABH, _____.
(a) EAB (b) ABC (c) BEF (d) BAE

33. The next term in the sequence is: I, HA, GBI, _____.
(a) FEFA (b) HCGA (c) FCHI (d) GCDT

34. The next term in the sequence is: R, SZ, TYR, _____.
(a) RSKV (b) UVUZ (c) BKNL (d) VUVZ

35. The next term in the sequence is: A, D, C, AF, E, CF, G, _____.
(a) I (b) AE (c) KT (d) FD

36. The next term in the sequence is: E, O, E, R, E, X, N, T, E, _____.
(a) N (b) O (c) P (d) Q

37. The odd one in the given sequence is: ABD, DGK, HMS, MTB, SCL, ZKW
(a) SCL (b) HMS (c) MTB (d) ZKW

38. The odd one in the given sequence is: X, U, C, P, N, K, I
(a) U (b) C (c) P (d) K

39. The odd one in the given sequence is: FDS, JHW, NLA, QND
(a) FDS (b) JHW (c) NLA (d) QND

40. The odd one in the given sequence is: CAT, KTC, IGZ, LJC
(a) CAT (b) KTC (c) IGZ (d) LJC

41. The odd one in the given sequence is: HBGQ, LFKU, PJYO, TNSC, XRWG
(a) HBGQ (b) LFKU (c) PJYO (d) TNSC

42. The odd one in the given sequence is: MHZ, NIW, OKT, QNP, QRN
(a) MHZ (b) NIW (c) OKT (d) QNP

43. The odd one in the given sequence is: AZ, TG, MN, SH, YB
(a) TG (b) MN (c) SH (d) YB

44. The odd one in the given sequence is: QPO, SRQ, UTS, WUV, YXW
(a) SRQ (b) UTS (c) WUV (d) YXW

45. The odd one in the given sequence is: YBE, WFD, UHG, SKI, QOL
(a) YBE (b) UHG (c) SKI (d) QOL

46. The odd one in the given sequence is: AZ, DX, FU, JQ
(a) AZ (b) DX (c) FU (d) JQ

47. The odd one in the given sequence is: ABD, DHK, HMS, MTB, SBL, ZKW
(a) DHK (b) HMS (c) MTB (d) SBL

48. The odd one in the given sequence is: ABP, CDQ, EFR, GIT
(a) ABP (b) CDQ (c) EFR (d) GIT

49. The odd one in the given sequence is: NSI, ORH, PQE, PPC, ROA
(a) NSI (b) ORH (c) PPC (d) ROA

50. The odd one in the given sequence is: QPO, SRQ, UST, WVU, YXW
(a) QPO (b) UST (c) WVU (d) YXW

51. The next term in the sequence is: 512BCD65, 343EFG50, 216HIJ37, 125KLM26, _____.
(a) 64NOP17 (b) 64PON17 (c) 49NOP15 (d) 49PON15

52. The next term in the sequence is: 17YXW65, 26VUT126, 37SRQ217, 50PON344, _____.
(a) 56MLK617 (b) 65MLK513 (c) 65KLM513 (d) 56KLM617

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53. The next term in the sequence is: ZY2505BA, XW1604DC, VU903FE, TS402HG, _____.
(a) TS402HG (b) ST402GH (c) RQ101JI (d) QR101IJ

54. The next term in the sequence is: 49BCD54, 60EFG67, 75HIJ84, 94KLM105, _____.
(a) 117NOP125 (b) 115PON125 (c) 115PON130 (d) 117NOP130

55. The next term in the sequence is: 101ZA82, 65YB50, 37XC26, 17WD10, _____.
(a) 7EV3 (b) 7VE2 (c) 5VE2 5EV3

56. The next term in the sequence is: 15ABC28, 18DEF32, 21GHI36, 24JKL40, _____.
(a) 27MNO44 (b) 32MON44 (c) 32ONM48 (d) 27MNO48

57. The next term in the sequence is: F6T20, H8V22, J10X24, _____
(a) L14Z30 (b) L12Z26 (c) M12X30 M14X26

58. The next term in the sequence is: J15K, M21N, P29Q, S39T, _____
(a) V49X (b) W51V (c) X49V (d) V51W

59. The next term in the sequence is: D23F, H19J, L17N, P13R, _____
(a) T11V (b) S13V (c) V11T (d) V13S

60. The next term in the sequence is: A70B, D65F, H60J, L55N, _____
(a) Q48S (b) R50P (c) P50R (d) S48Q

61. The next term in the sequence is: J2Z, K4X, L7V, M11T, N16R, _____
(a) R20P (b) O22P (c) P22O (d) P20R

62. The missing term in the sequence is: XZ16BD, _____, NP144RT, VX256ZB, DF400HJ
(a) HF64LJ (b) FH54LJ (c) FH64JL (d) HF54JL

63. The missing term in the sequence is: _____, CQ28, FU40, JX56, OZ76
(a) BP18 (b) PB18 (c) LA10 (d) AL20

64. The missing term in the sequence is: A3T, D7R, G16P, _____, M74L, P153J
(a) J35N (b) K26O (c) J40N (d) K30O

65. The missing term in the sequence is: 4A, _____, 28G, 60J, 124M, 252P
(a) 12D (b) 14E (c) 12E (d) 14D

66. The missing term in the sequence is: P3C, R5F, _____, V12L, X17O
(a) S8J (b) T8I (c) T9J (d) S9J

67. The missing term in the sequence is: _____, N13E, Q20Z, T31V, W44S
(a) K8K (b) L8K (c) K9L (d) L9L

68. The missing term in the sequence is: A729, G343, M125, _____, Y1
(a) P28 (b) P27 (c) S28 (d) S27

69. The missing term in the sequence is: C24W4, D23V5, _____, F21T7
(a) E22U6 (b) E24V6 (c) E22W8 (d) E24V8

70. The missing term in the sequence is: 5G7, _____, 10I14, 14J19, 19K25
(a) 8H10 (b) 9I12 (c) 7H10 (d) 7H12

71. The missing term in the sequence is: 2A11, 4D13, _____, 48J23
(a) 12G17 (b) 14H18 (c) 12H17 (d) 14G18

72. The missing term in the sequence is: D4, F6, _____, J10, L12
(a) H9 (b) H8 (c) G8 (d) G9

73. The missing term in the sequence is: 3F, _____, 11I, 18L, 27P
(a) 8H (b) 8G (c) 6H (d) 6G

74. The missing term in the sequence is: A, _____, L, P, S, U
(a) G (b) H (c) I (d) J

75. The odd one in the given sequence is: KM5, IP8, GS11, EW14, CY17
(a) IP8 (b) GS11 (c) EW14 (d) CY17

76. The odd one in the given sequence is: 2A11, 4D13, 12G17, 50J23
(a) 2A11 (b) 4D13 (c) 12G17 (d) 50J23

77. The odd one in the given sequence is: C2, D3, G4, I5, K6
(a) C2 (b) D3 (c) G4 (d) I5

78. The odd one in the given sequence is: K11, M13, Q18, T20, Y25
(a) K11 (b) M13 (c) Q18 (d) Y25

79. The odd one in the given sequence is: B0R, E3U, G9Y, J18D, M30K
(a) B0R (b) G9Y (c) J18D (d) M30K

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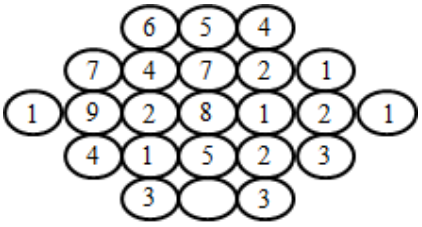
80.	The odd one in the given sequence is: 6C7, 8F10, 11J14, 14O19, 20U25			
	(a) 8F10	(b) 11J14	(c) 14O19	(d) 20U25
81.	The odd one in the given sequence is: 2Z5, 7Y7, 14X9, 24W11, 34V13, 47U15			
	(a) 2Z5	(b) 14X9	(c) 24W11	(d) 47U15
82.	The odd one in the given sequence is: 1CV, 5FU, 9IT, 14LS, 17OR			
	(a) 5FU	(b) 9IT	(c) 14LS	(d) 17OR
83.	The odd one in the given sequence is: B0R, G3U, E3P, J6S, H9O			
	(a) G3U	(b) E3P	(c) J6S	(d) H9O
84.	The odd one in the given sequence is: G4T, J8R, M20P, P43N, S90L			
	(a) G4T	(b) J8R	(c) M20P	(d) P43N

7.5 Missing Number or Alphabet or both in the Figure

In this type of questions, a set of figures or simply one figure, each containing certain number or a set of letters, combination of numbers and letters in a certain pattern are given. We have to find a missing character in the figure. Let us consider some example:

Example [GA-2015 (2 mark)]: Fill the missing value. _____

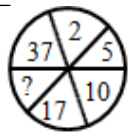


Solution: We note that the middle number in all the numbers lying in horizontal line is the half of the sum of all number lying on that line. For e.g. in the first line $5=(6+4)/2$; similarly in the second line $7=(7+4+2+1)/2$ and so on. So in the last line, the missing value is $(3+3)/2=3$.

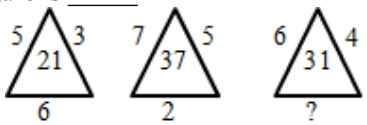
Exercise: 7.3

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. The missing character in the given figure is _____



2. The missing character in the given figure is _____



3. The missing character in the given table is _____

2	4	6	8	10	12
3	17	35	65	?	145

4. The missing character in the given table is _____

1	3	5
7	9	11
50	90	?

5. The missing character in the given table is _____

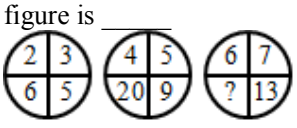
2	4	6	8
6	7	4	9
4	8	?	16
12	14	16	18

6. The missing character in the given table is _____

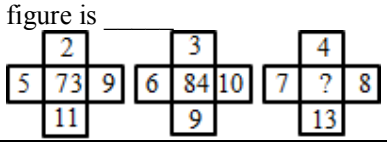
G	N	W
J	R	B
N	W	?

(a) F (b) G (c) H (d) I

7. The missing character in the given figure is _____



8. The missing character in the given figure is _____



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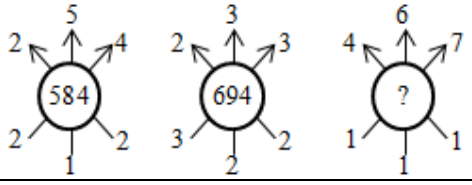
9. The missing character in the given figure is _____



10. The missing character in the given figure is _____

V3	T4	R2
N30	L66	?
G3	E2	C1

(a) B7 (b) J9 (c) K10 (d) N8

11. The missing character in the given table is _____

5	3	16
9	5	6
36	16	?

12. The missing character in the given table is _____

11	3	64
5	19	?
7	13	36

13. The missing character in the given table is _____

3	6	50
5	8	94
4	7	?

14. The missing character in the given table is _____

3	17	4
7	22	5
3	?	5

15. The missing character in the given table is _____

1	7	9
2	14	?
4	112	110

16. The missing character in the given table is _____

5	28	3
9	86	5
11	?	7

17. The missing character in the given table is _____

12	37	28
10	52	4
?	83	24

18. The missing character in the given table is _____

1	2	4
11	7	6
120	45	?

19. The missing character in the given table is _____

13	54	?
8	45	32
29	144	68

20. The missing character in the given table is _____

18	24	37
12	14	21
3	?	6

21. The missing character in the given table is _____

7	9	28	36
4	2	36	18
9	4	54	?

22. The missing character in the given table is _____

2	4	6	8
1	3	?	7
9	91	341	855

23. The missing character in the given table is _____

5	9	7
4	5	3
3	4	8
4	6	?

24. The missing character in the given table is _____

11	6	10
17	12	?
25	34	19
19	28	11

25. The missing character in the table is __

1	2	3	4
1	5	11	?

26. The missing character in the table is __

1	2	3	4
1	3	?	13

27. The missing character in the given table is _____

9	9	12
13	10	7
8	?	11

28. The missing character in the given table is _____

3I	27K	9M
7D	21G	3J
4H	?	7P

(a) 28L (b) 18M (c) 4N (d) 6K

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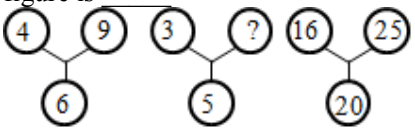
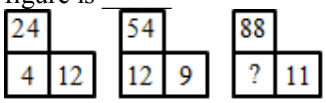
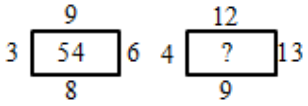
29. The missing character in the given figure is _____



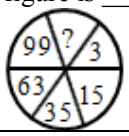
30. The missing character in the given figure is _____



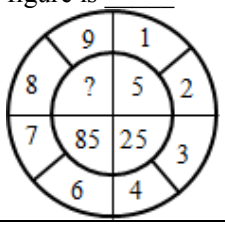
31. The missing character in the given figure is _____



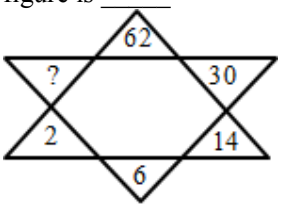
32. The missing character in the given figure is _____



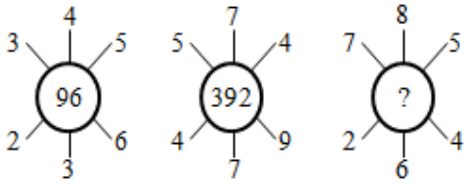
33. The missing character in the given figure is _____



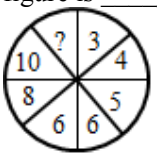
34. The missing character in the given figure is _____



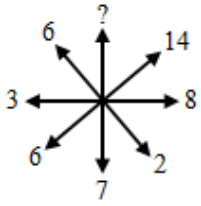
35. The missing character in the given figure is _____



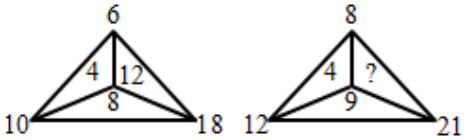
36. The missing character in the given figure is _____



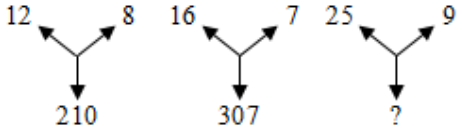
37. The missing character in the given figure is _____



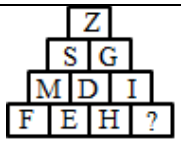
38. The missing character in the given figure is _____



39. The missing character in the given figure is _____



40. The missing character in the given figure is _____



(a) L (b) B (c) D (d) G

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Answers

Answer Keys: Exercise: 7.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	24	677	162	25	54	407	40	92	49	108	17	177	1127	10
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
143	192	479	911	68	240	15	36	25	28	55	14	336	25	100
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
427	b	c	a	d	b	b	a	b	d	d	d	b	c	b
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
d	a	d	d	b	d	a	d	c	c	c	b	b	b	a
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**				
c	d	b	b	d	b	a	d	d	c	c				

Answer Keys: Exercise: 7.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
c	c	b	a	d	a	b	c	d	d	c	b	a	a	a
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
c	a	b	a	c	c	a	b	d	a	b	c	d	b	d
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
b	c	a	b	d	a	a	b	d	b	c	d	a	c	a
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	a	d	b	b	a	b	c	d	c	a	b	d	a	c
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
b	c	d	a	a	b	a	d	a	c	a	b	d	a	c
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**						
d	b	c	d	c	c	c	d	b						

Answer Keys: Exercise: 7.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
26	7	99	126	24	c	42	123	674	b	97	196	70	18	11
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
128	64	20	4	8	6	5	6	18	19	7	11	a	4	16
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**					
56	143	143	126	328	12	16	13	708	d					

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Chapter 8 : Speed, Distance, Time, Work, Day and Clocks

8.1 Speed, Time and Distance

- $\text{Speed} = \text{Distance}/\text{Time}$; $\text{Time} = \text{Distance}/\text{Speed}$; $\text{Distance} = \text{Speed} \times \text{Time}$
- $1\,\text{km/hr} = (5/18)\,\text{m/s}$; $1\,\text{m/sec} = (18/5)\,\text{km/hr}$
- If the ratio of the speed of A and B is $a:b$, then the ratio of the time taken by them to cover the same distance is $(1/a):(1/b)$ or $b:a$.
- $\text{Average Speed} = \dfrac{\text{Total distance}}{\text{Total Time}}$; $\text{Average Velocity} = \dfrac{\text{Net displacement}}{\text{Total Time}}$
- Suppose a person covers x km distance in t_1 hours and y km distance in t_2 hours, then the average speed during the whole journey is $\{(x+y)/(t_1+t_2)\}$ km/hr.
- Suppose a person covers a distance d_1 at x km/hr and a distance d_2 at y km/hr, then the average speed during the whole journey is $\{(d_1+d_2)/((d_1/x)+(d_2/y))\}$ km/hr.
- Suppose a person covers a distance at x km/hr and an equal distance at y km/hr, then the average speed during the whole journey is $\{2xy/(x+y)\}$ km/hr.
- Suppose a person travels at the rate of x km/hr for t_1 hours and again at the rate of y km/hr for another t_2 hours, then average speed for the whole journey is $\{(xt_1+yt_2)/(t_1+t_2)\}$ km/hr.

Example [GA-2013 (2 marks)]: A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. The average speed of the tourist in km/h during his entire journey is

(a) 36 (b) 30 (c) 24 (d) 18

Solution (c): Let x be the total distance covered by a tourist. Then, time taken to cover $x/2$ of journey at 60km/hr is $t_1 = (x/2)/60 = x/120$; time taken to cover $x/4$ of journey at 30km/hr is $t_2 = (x/4)/30 = x/120$; time taken to cover $x/4$ of journey at 10km/hr is $t_3 = (x/4)/10 = x/40$. Thus average speed during the entire journey is given as

$$S_{avg} = \frac{\text{total distance}}{\text{total time}} = \frac{(x/2)+(x/4)+(x/4)}{t_1+t_2+t_3} \Rightarrow S_{avg} = \frac{(x/2)+(x/4)+(x/4)}{(x/120)+(x/120)+(x/40)} = 24\,\text{km/hr}.$$

Example [GA-2013 (2 marks)]: A car travels 8 km in the first quarter of an hour, 6 km in the second quarter and 16 km in the third quarter. The average speed of the car in km per hour over the entire journey is

(a) 30 (b) 36 (c) 40 (d) 24

Solution (c): Average speed $S_{avg} = \dfrac{\text{total distance}}{\text{total time}} = \dfrac{8+6+16}{(1/4)+(1/4)+(1/4)} = 40\,\text{km/hr}.$

Example [GA-2013 (2 marks)]: Velocity of an object fired directly in upward direction is given by $V = 80 - 32t$, where t (time) is in seconds. When will the velocity be between 32 m/sec and 64 m/sec?

(a) $(1, 3/2)$ (b) $(1/2, 1)$ (c) $(1/2, 3/2)$ (d) $(1, 3)$

Solution (c): We have to find the range of values of t for which the given velocity-time relation exists between $(32, 64)$; thus $32 < 80 - 32t < 64 \Rightarrow 16 < 32t < 48 \Rightarrow \dfrac{1}{2} < t < \dfrac{3}{2}$.

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Relative Speed: Relative movement can be viewed as the movement of an object w.r.t. another moving object.

- Two objects are moving in opposite direction at speeds S_1 and S_2, respectively; then the relative speed is defined as $S_{rel} = S_1 + S_2$.
- Two objects are moving in same direction at speeds S_1 and S_2, respectively; then the relative speed is defined as $S_{rel} = |S_1 - S_2|$.
  - If $S_1 > S_2$ then $S_{rel} = S_1 - S_2$
  - If $S_1 < S_2$ then $S_{rel} = S_2 - S_1$
- The concept of relative speed is used in solving the train, boat problems, to and fro motion in a straight line which are discussed in next sections.

Example [GA-2015 (2 marks)]: A tiger is 50 leaps of its own behind a deer. The tiger takes 5 leaps per minute to the deer's 4. If the tiger and deer covers 8 metre and 5 metre per leap respectively, what distance in metres will the tiger have to run before it catches the deer? ___.

Solution: Solution: As the tiger covers 8 metres in a leap and the tiger takes 5 leaps per minute, speed of tiger is $S_T = 5\,\text{leaps}/\text{min} = 5 \times 8\,\text{m}/\text{min} = 40\,\text{m}/\text{min}$. Similarly, speed of deer is $S_D = 4\,\text{leaps}/\text{min} = 4 \times 5\,\text{m}/\text{min} = 20\,\text{m}/\text{min}$. For tiger, the distance between tiger and deer is $50 \times 8 = 400$ metres. As the relative speed of tiger w.r.t. deer is $S_{rel} = S_T - S_D = 40 - 20 = 20\,\text{m}/\text{min}$. So time take to cover the 400 metres of distance is $t = 400/20 = 20$ min. Now in 20 minutes the tiger covers a distance of $40 \times 20 = 800$ metres.

Train Problems: The basic relation for train problems is the same relation for speed, time and distance, i.e. $\text{Distance} = \text{Speed} \times \text{Time}$. The following points need to be kept in mind before tackling the train problems.

- When the train is crossing a moving object, the speed has to be taken as the relative speed of the train w.r.t. the object.
- The distance to be covered when crossing an object whenever a train crosses an object will be equal to: 'Length of train' plus 'Length of object'.
- Time taken by a train of length l metres to pass an object is equal to the time taken by the train to cover l metres.
- Time taken by a train of length l metres to pass a stationary object of length b metres is the time taken by the train to cover $(l + b)$ metres.
- Suppose two trains or two bodies are moving in the same direction at u m/s and v m/s, where $u > v$, then their relatives speed is $(u - v)$ m/s.
- Suppose two trains or two bodies are moving in opposite directions at u m/s and v m/s, then their relative speed is $(u + v)$ m/s.
- If two trains of length x metres and y metres are moving in opposite directions at u m/s and v m/s, then time taken by the trains to cross each other is $(x + y)/(u + v)$ sec.
- If two trains of length x metres and y metres are moving in the same direction at u m/s and v m/s with $u > v$, then time taken by the faster train to cross the slower train is $(x + y)/(u - v)$ sec.
- If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take x and y seconds in reaching B and A respectively, then the ratio of $(A\text{'s speed} : B\text{'s speed}) = (b^{1/2} : a^{1/2})$.

Now let $S_T =$ the speed of train; $S_o =$ speed of an object; $L_T =$ length of the train; $L_O =$ length of an object; $t =$ the time. We have the following situation based on the given problems:

- Train crossing a stationary object without length: $S_T \times t = L_T$

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- Train crossing a stationary object with length: $S_T \times t = (L_T + L_O)$
- Train crossing a moving object without length:
  - In opposite direction: $(S_T + S_O) \times t = L_T$
  - In same direction: $(S_T - S_O) \times t = L_T$
- Train crossing a moving object with length:
  - In opposite direction: $(S_T + S_O) \times t = (L_T + L_O)$
  - In same direction: $(S_T - S_O) \times t = (L_T + L_O)$

Example [GA-2014 (2 marks)]: A train that is 280 metres long, travelling at a uniform speed, crosses a platform in 60 seconds and passes a man standing on the platform in 20 seconds. What is the length of the platform in metres?

Solution: From the given data we have length of train $L_T = 280$ m; let length of platform is L_P; let speed of train is S_T. So when train that crosses a platform in 60 seconds, then $S_T \times 60 = L_T + L_P$ …(i). When a train passes a man standing on the platform in 20 seconds, then $S_T \times 20 = L_T \Rightarrow S_T = 280/20 = 14$ …(ii). Putting (ii) in (i) we get $14 \times 60 = 280 + L_P \Rightarrow L_P = 560$ m.

Example [GA-2016 (2 marks)]: It takes 10 s and 15 s, respectively, for two trains travelling at different constant speeds to completely pass a telegraph post. The length of the first train is 120 m and that of the second train is 150 m. The magnitude of the difference in the speeds of the two trains (in m/s) is _____.

(a) 2.0 (b) 10.0 (c) 12.0 (d) 22.0

Solution (a): Let v_1 and l_1 are the speed and length of 1st train; and v_2 and l_2 are the speed and length of 2nd train. The time taken to completely pass a telegraph post by 1st train and 2nd train is 10 sec and 15 sec.

So $l_1 = v_1 \times 10 \Rightarrow v_1 = l_1/10 = 120/10 = 12$ m/sec; and $l_2 = v_2 \times 15 \Rightarrow v_2 = l_2/10 = 150/15 = 10$.

Thus the magnitude of the difference in the speeds of the two trains is $|v_1 - v_2| = |12 - 10| = 2$ m/sec.

Hence option (a) is correct.

Boat Problems: The basic relation for boat problems is the same relation for speed, time and distance, i.e. Distance = Speed × Time. The following points need to be kept in mind before tackling the boat problems.

- The speed at which the boat moves in still water is called the speed of boat in still water.
- If there is movement for water then it is called stream. The rate at which water flows is called rate of stream or rate of flow.
- The direction along the stream is called 'downstream' and the direction against the stream is called 'upstream'.
- If the speed of the boat in still water is S_B and the speed of the stream is S_S, then
  - Downstream speed is $S_D = (S_B + S_S)$
  - Upstream speed is $S_U = (S_B - S_S)$
- If the downstream speed is S_D and the upstream speed is S_U, then
  - Speed of boat in still water is $(S_D + S_U)/2$
  - Speed of the stream is $(S_D - S_U)/2$
- If a boat travels a distance of x km and returns in t hours of time then $x = \dfrac{t(S_B^2 - S_S^2)}{2S_B}$
- If the boat travels a certain distance and returns back then the average speed (S_{avg}) for the whole journey is $S_{avg} = (S_B^2 - S_S^2)/(S_B - S_S)$.

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- If the time taken by train to travel a certain distance upstream is k times the time taken by the boat to travel the same distance downstream then $S_B/S_S = (k+1)/(k-1)$.

Example [GA-2014 (2 mark)]: A man can row at 8 km per hour in still water. If it takes him thrice as long to row upstream, as to row downstream, then find the stream velocity in km per hour.

Solution: From the given data we have $S_B = 8$ km/hr.; let t_U and t_D be the time taken to row x distance in upstream and downstream, respectively; let S_S be the speed of stream; S_U and S_D are the upstream and downstream speeds. Then we have

$t_U = \frac{x}{S_U} = \frac{x}{S_B - S_S}$ …(i); and $t_D = \frac{x}{S_D} = \frac{x}{S_B + S_S}$ …(ii). As $t_U = 3t_D \Rightarrow \frac{x}{S_B - S_S} = \frac{3x}{S_B + S_S}$

$\Rightarrow 1/(8 - S_S) = 3/(8 + S_S) \Rightarrow 8 + S_S = 24 - 3S_S \Rightarrow S_S = 4$ km/hr.

To and Fro Motion in a Straight Line: The basic principal used here is distances travelled by the bodies after the start of the movement are always in the ratio of their respective speeds since the two movements can be described as having the time constant between them. Then we have:

- **Two bodies starts from the same point and moving in the same direction:** When two bodies (B_1 and B_2) starts from the same point and moving in the same direction; and they move to and fro between the two points A and B. Let S_1 and S_2 ($S_1 > S_2$) are the speeds of bodies B_1 and B_2, respectively. The body B_1 will reach the end first and will meet the second body on its way back. The relative speed $S_1 - S_2$ will apply till the point of reversal of the body B_1 and after that both bodies will start to move in opposite direction at a relative speed $S_1 + S_2$. When the body B_2 will reach the end first time and after reversal both bodies moves in same direction so the relative speed will again become $S_1 - S_2$. Thus the relative speed governing the movement of the two bodies will take the value either $S_1 - S_2$ or $S_1 + S_2$. Now for the first and successive meeting of two bodies, the total distance covered by both bodies for each meeting will be $2D$, where D is the distance between the extreme points. Thus for the n^{th} meeting the total distance covered by both bodies will be $n \times (2D)$, where $n = 1, 2, 3 \cdots$. The respective coverage of the distance is in the ratio of their individual speed.

- **Two bodies starts from the opposite points and moving in the opposite direction:** When two bodies (B_1 and B_2) starts from the opposite point and moving in the opposite direction; and they move to and fro between the two points A and B. Let S_1 and S_2 ($S_1 > S_2$) are the speeds of bodies B_1 and B_2, respectively. Firstly both the bodies meet somewhere between the two points A and B. The body B_1 will reach the end first and the relative speed $S_1 + S_2$ will apply till the point of reversal of the body B_1 and after that both bodies will start to move in same direction at a relative speed $S_1 - S_2$. When the body B_2 will reach the end first time and after reversal both bodies moves in opposite direction so the relative speed will again become $S_1 + S_2$. So, the relative speed governing the movement of the two bodies will take value either $S_1 - S_2$ or $S_1 + S_2$. Now the total distance covered by both bodies for their first meet will be D, where D is the distance between the extreme points. For every successive meeting of the bodies, the total distance covered by both bodies for each meeting will be $2D$. Thus for the n^{th} meeting the total distance covered by both bodies will be $D + (n-1) \times 2D$, where $n = 2, 3, 4, \cdots$. The respective coverage of the distance is in the ratio of their individual speed.

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Exercise 8.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	Two buses A and B start simultaneously from a certain place at the speed of 30 km/h and 45 km/h, respectively. The bus B reaches the destination two hours earlier than bus A. What is the distance (in km) between the starting point and destination? _____
2.	A man cycles with a speed of 10 km/h and reaches his home at 7 PM. If he runs a bike at 15 km/h, he reaches his home at 5 PM. At what speed (in km/h) should he cycle, so that he reaches his office at 6 PM? _____
3.	If a body covers a distance at the rate of 3 km/h and another equal distance at the rate of 9 km/h, then the average speed of the body (in km/h) is _____
4.	Ashok travels a certain distance at 3 km/h and reaches 15 minutes later. If he travels at 4 km/h, he reaches 15 minutes earlier. The distance (in km) he has to travel is _____
5.	A bus is travelling at a constant speed of 45 km/h. The distance (in km) travelled by the bus from $11:40$ AM to $2:00$ PM is _____
6.	A bus travels along the four sides of a square at speeds $4v$, $3v$, $2v$ and v, respectively. If u is the average speed of the car in its travel around the square, then which one of the following is correct? (a) $2v < u < 3v$ (b) $3v < u < 4v$ (c) $v < u < 2v$ (d) $4v < u < 5v$
7.	Amit walks from A o B at the rate of 2.5 km/h and then B to A at the rate of 3.25 km/h. If the total time required to walk from A to B to A is 4 hours and 36 minutes, what is the distance (in km) between A to B? _____
8.	Amit and Suresh starts running at a point A with speeds of 12 km/h and 18 km/h, respectively and reach another point B. If Suresh starts, one hour after Amit, from A and reaches B, one hour before Amit, what is the distance (in km) between A and B? _____
9.	A and B starts from a place walking at 5 km/h and 6.5 km/h, respectively. What is the time (in minutes) they will take to be 92 km apart, if they walk in opposite directions? _____
10.	Pawan and Rahul starts walking at the same time from place A to place B, 60 km away. Pawan travel 4 km/h alower than Rahul. Rahul reaches place B and at once turns back meeting Pawan, 12 km from city Rahul. What is the speed (in km/h) of Pawan?
11.	A boy walks from place A to place B at 2.5 km/h and arrives 12 minutes late. The next day he walks at 4 km/h and reaches the place B 15 minutes earlier. What is the distance (in km) from place A to B? _____
12.	A car travels a distance of 200 km at a constant speed. If the speed of the car is increased by 5 km/h, the time take to cover the same distance is two hours less. What is the speed (in km/h) of the car? _____
13.	A person covers a certain distance in 10 hours. He covers half the distance at 30 km/h and the rest at 70 km/h. What is the total distance (in km) of the journey? _____
14.	A person covers a certain distance x by bus. If the bus moves 4 km/h faster, it would take 30 minutes less. If the bus moves 2 km/h, it would have taken 20 minutes more. Find x (in)
15.	A bus moves at a certain speed for a distance of 800 km. The bus could have saved 40 minutes by increasing the average speed of the bus by 40 km/h. Find the average speed (in km/h) of the bus? _____
16.	A bus moves 10 km/h faster than a car for a journey of 1000 km. The car takes five hours more than the bus. Find the speed (in km/h) of the car? _____
17.	If a car runs at $7/11$ of its own speed reached a place in 22 hours. How much time (in hours) could be saved if the car runs at its own speed? _____
18.	A person takes 15 minutes less to cover a distance of 75 km. If he increases its speed by 10 km/h from its usual speed, how much time (in minutes) would it take to cover a distance of 300 km using this speed? _____
19.	Mahesh and Ravi are running towards each other, each one from his own house. Mahesh can reach Ravi's house in 25 minutes of running, which is half the time it takes Ravi to reach

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	Mahesh's house. If the two started to run at the same time, how much more time (in minutes) will it take Ravi to reach the middle than Mahesh? _____
20.	Two bodies A (with speed 120 km/h) and B (with speed 15% slower than A) are travelling on the same straight path towards each other. How much time (in minutes) will it take the bodies to meet, if the initial distance between the two is 668.4 km and body A started to move 1.5 hours before body B started? _____
21.	A train left 30 minutes later than its scheduled time to reach its destination 1500 km away. In order to reach in time it increases its speed by 250 km/h. What is its original speed (in km/h)? _____
22.	For moving from point A to B, if Amit runs at 4 km/h, he will be 15 minutes late; if he runs at 6 km/hr, he will reach point B 10 minutes soon. What is the distance (in km) between A and B? _____
23.	A car travels a distance of 300 km at constant speed. If its speed is increased by 5 km/h, the journey would have taken 2 hours less. The original speed (in km/h) of the car was _____.
24.	A person takes 6.5 hours in going on foot and coming back by cycle. He would have lost 130 minutes by going on foot both ways. How long (in minutes) would it take him to go by cycle both ways? _____.
25.	In a race of 600 m between A and B, A can beat B by 60 m. In a race of 500 m between three friends B and C, B can beat C by 25 m. By how many meters will A beats C in a 400 m race? _____
26.	Ramesh's and Suresh's speed is the ratio $3:4$. If Ramesh takes 30 minutes more than Suresh to cover a distance, then the actual time (in hours) taken by Ramesh is _____
27.	Arun goes from P to Q, a distance of 192 km, at an average speed of 32 km/h. Amit starts from P, 2.5 hours after Arun and reaches Q half an hour earlier. What is the ratio of the speeds of Arun and the Amit? (a) $1:2$ (b) $2:3$ (c) $3:4$ (d) $4:5$
28.	Arun travels a distance of 45 km at the speed of 15 km/h. It covers the next 50 km of its journey at the speed of 25 km/h and the last 25 km of its journey at the speed of $25/3$ km/h. What is the average speed (in km/h) of the car? _____
29.	A bus travels a distance of 170 km in two hours partly at a speed of 100 km/h and partly at 50 km/h. The distance (in km) travelled at speed of 50 km/h is _____
30.	A train is scheduled to cover the distance between two stations 46 km apart in one hour. If it travels 25 km at a speed of 40 km/h, find the speed (in km/h) for the remaining journey to complete it in the scheduled time? _____
31.	On a straight path, a bus started from point A and proceeds towards point B at a speed of 48 km/h. After 0.75 hours, another bus started from point B and proceeds towards point A at 50 km/h. If the distance between the two points is 232 km, at what distance (in km) from point A will the two buses meets? _____
32.	A person while travelling from bike counts the electric poles on the road as he passes them. The electric poles are at a distance of 50 m. What will be his count in four hours if he runs the bike at the speed of 45 km/h.? _____
33.	In fog, a bike passes a person who was walking at the rate of 2 km/h in the same direction. The person could see the bike for six minutes and it was visible to him up to a distance of 600 m. What was the speed (in km/h) of bike? _____
34.	Three friends are running in a ground with some speed which are in the ratio of $2:3:4$. The ratio between the times taken by them to cover the same distance is (a) $4:3:2$ (b) $6:4:3$ (c) $2:3:4$ (d) $4:3:6$
35.	In 6.75 hours, a person starts walking from A to B and returns to A by bus. He would have gained two hours if he took bus for travelling from A to B to A. How long (in minutes) would it have taken for him to walk from A to B to A. _____
36.	A bullet train covers distances 2500 km, 1200 km and 500 km at the rate of 500 km/h, 400 km/h and 250 km/h, respectively. The average speed (in km/h) of the bullet train is _____
37.	A long distance runner runs 9 laps of a 400 m track every day. His timings (in minutes) for

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	four consecutive days are 88, 89, 91 and 92, respectively. On an average, how many m/min does the runner cover? _____
38.	A person walks half of the journey at 4 km/h, one-third of the journey at 12 km/h and remaining journey at 9 km/h, thus completing the whole journey in 372 minutes. The total length (in km) of the journey is _____.
39.	Monica and Shweta ran a race which lasted a minute and a half. Monica gave Shweta a start of 9 m and beat her by 1 m. Monica ran 40 m while Shweta ran 39 m. The total length (in km) of the race course is _____.
40.	Two cars one moving towards South and the other towards West, leave the same place at the same time. The speed of one of them is greater than that of the other by 5 km/h. At the end of two hours, they are at a distance of 50 km from each other. What is the speed (in km/h) of the bus going slower? _____
41.	Bus A leaves Lucknow for Haldwani at 11 AM, running at the speed of 60 km/h. Bus B leaves Lucknow for Haldwani by the same route at 2 PM on the same day, running at the speed of 72 km/h. At what time will the two buses meet each other? (a) 2 AM on the next day (b) 2 PM on the next day (c) 5 PM on the next day (d) 5 AM on the next day
42.	Amit and Bhawna start running from point P to point Q at the rate of 3 km/h and 4 km/h, respectively. The distance between these two points is 21 km. Bhawna reaches to the point Q and returns immediately and meets Amit at a point R. What is the distance (in km) between Q and R? _____
43.	Excluding stoppages, if the bus runs at the rate of 54 km/h. Including stoppages, it runs at the rate of 45 km/h. For how many minutes does the bus stop per hour? _____
44.	A bus starts running with the initial speed of 40 km/h, with its speed increasing every hour by 5 km/h. How many minutes will it take to cover a distance of 385 km? _____
45.	A train starts from Point A at $6:00$ AM and reaches Point B at $10:00$ AM. The other train starts from Point B at $8:00$ AM and reaches Point A at $11:30$ AM. If the distance between Point A and Point B is 200 km, then at what time did the two trains meet each other? (a) $8:56$ AM (b) $8:50$ AM (c) $7:56$ AM (d) $7:50$ AM
46.	An express train travelled at an average speed of 100 km/h, stopping for 3 minutes after 75 km. A local train travelled at a speed of 50 km/h, stopping for 1 minute after every 25 km. If the trains began travelling at the same time, how many kilometres did the local train travel in the time it took the express train to travel 600 km. _____
47.	A bullet train first runs with a speed of 440 km/h and covered a certain distance. It still had to cover 770 km less than what it had already covered but it runs with a speed of 660 km/h. The average speed for the entire journey was 550 km/h. Find the total distance (in km) covered. __
48.	Train A running at 60 km/h leaves Station P for Station Q at 6 PM. Train B running at 90 km/h also leaves Station P for Station Q at 9 PM. Train C leaves Station Q for Station P at 9 PM. If all the three trains meet at the same time between Station P and Station Q then what is the speed (in km/h) of train C if distance between Station Q and Station P is 1260 km? _____
49.	A sport car can travel 20 % faster than a normal car. Both start from the point A at the same time and reach point B, 75 km away from A at the same time. On the way however the sport car lost about 12.5 minutes while stopping for change of tires. The speed (in km/h) of the normal car is _____
50.	There are 20 poles with a constant distance between each pole. A bike takes 24 seconds to reach the 12^{th} pole. How much time (in seconds) will it take to reach the last pole? _____
51.	It takes 8 hours for a 600 km journey, if 120 km is done by bus and rest by bike. It takes 20 minutes more, if 200 km is done by bus and the rest by bike. What is the ratio of the speed of the bus to that of the speed of the bike? (a) $4:3$ (b) $3:2$ (c) $2:3$ (d) $3:4$
52.	Points A and B are 70 km apart on a highway. One bus starts from A and the another one from B at the same time. If buses travel in the same direction, they meet in seven hours. But if the buses travel towards each other, they meet in one hour. The speed (in km/h) of slower

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	bus is _____.
53.	A journey of 192 km between two cities takes two hours less by a fast car than by a slow car. If the average speed of the slow car is 16 km/h less than that of the fast car, then the average speed (km/h) of the fast car is _____.
54.	In a flight of 3000 km an aircraft was slowed down by bad weather. If average speed for the trip was reduced by 100 km/h and the time increased by one hour, find the original duration (in minutes) of the flight. _____
55.	Two cars are approaching each other, one at 42 km/h and the other at 18 km/h. They start 30 km apart. How far are they apart (in km) one minute before impact? _____
56.	Two bikes start together in the same direction from the same place. The first goes with a uniform speed of 10 km/h. The second goes at a speed of 8 km/h in the first hour and increase the speed by 0.5 km each in succeeding hour. After how many minutes will the second car overtake the first if both go non-stop? _____
57.	In climbing a 21 m long electric pole, a monkey climbs 6 m in the first minute and slips 3 m in the next minute. What time (in minutes) the monkey would take to reach the top of the pole? _
58.	A certain distance is covered by a bus with a certain speed. If half the distance is covered in double time, then the ratio of this speeds to that of the original is (a) 1 : 4 (b) 4 : 1 (c) 1 : 2 (d) 2 : 1
59.	There is a 50m long army platoon marching ahead. The last person in the platoon wants to give a letter to the first person leading the platoon. So while the platoon is marching he runs ahead, reaches the first person and hands over the letter to him and without stopping he runs and comes back to his original position. In the mean-time the whole platoon has moved ahead by 50m. Assuming that he ran the whole distance with uniform speed, how much is distance (in m) did the last person cover in that time. _____
60.	Train A, which goes from Station P to Station Q, leaves Station P at 5 : 30 AM and travels at a constant speed of 50 km/h towards Station R which is 100 km away. At 6 : 00 AM, train B leaves from Station R for Station P at a constant speed of 40 km/h. At 6 : 30 AM, the Control Officer realizes that both the trains are on the same track. How much time (in minutes) does he have to avert the accident? _____
61.	The average speed of a bus is 20% less on the return journey than on the onward journey. The bus halts for half an hour at the destination station before starting on the return journey. If the total time taken for the to and fro journey is 23 hours, covering a distance of 1000 km, the speed (in km/h) of the bus on the return journey is _____
62.	A train overtakes two persons walking along a railway track. The first one walks at 4.5 km/h. The other one walks at 5.4 km/h. The train needs 8.4 sec and 8.5 sec, respectively to overtake them. What is the speed (in m/s) of the train if both the persons are walking in the same direction as the train? _____
63.	A train travelling at 48 km/h completely crosses another train having half its length and travelling in opposite direction at 42 km/h in 12 seconds. It also passes a railway platform in 45 seconds. The length of the platform (in km) is _____.
64.	A train travelling at 100 km/h overtakes a motorbike travelling at 64 km/h in 40 seconds. What is the length of the train (in km)? _____
65.	A train passing over a 1000 m long bridge. The length of the train 500 m. If the train clears the bridge in 120 seconds, the speed of the train (in m/s) is _____
66.	A person sitting in a train A, which moves at the rate of 50 km/h, observes that it takes 9 seconds for another train B, which moves in opposite direction, to pass him. If train B is of length 187.5 m long, find its speed (in km/h) _____
67.	A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 15 m/s, find the length (in m) of the platform. _____
68.	Two trains 130 m and 110 m long, are going in the same direction. The faster train takes one minute to pass the other completely. If they are moving in opposite directions, they pass each other completely in three seconds. Find the speed (in m/s) of the slower train.
69.	A train consist of 12 compartments; each compartment is 15 m long. The train crosses an electric pole in 18 seconds. If two compartments were detached, then in how much time (in

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	seconds) will the train cross an electric pole?
70.	A train 75 m long overtook a person who was walking at the rate of 6 km/h and passes him in 7.5 seconds. Subsequently, it overtook a second person and passes him in 6.75 seconds. At what speed (in km/h) was the second person travelling?
71.	Two trains, of length 1100 m and 900 m, respectively, are moving in opposite directions at the rate of 60 km/h and 90 km/h, respectively. What is the time taken by the slower train to cross the faster train in minutes is _____
72.	Sultanpur is 100 km from Sultankari. At 3 PM, Train A leaves Sultanpur for Sultankari and travels at a constant speed of 30 km/h. One hour later, Train B leaves Sultankari for Sultanpur and travels at a constant speed of 40 km/h. Each train makes one stop only at a station 10 km from its starting point and remains there for 15 minutes. Which train is nearer to Sultanpur? (a) Both are equidistant (b) Train B (c) Train A (d) Data insufficient
73.	A train with speed 25 m/s crosses a bridge in 36 seconds. Another train 100 m shorter crosses the same bridge with speed 12.5 m/s. What is the time taken (in seconds) by the second train to cross the bridge? _____
74.	Two trains of equal length are running on parallel tracks in the same direction at 46 km/h and 10 m/s. The faster train passes the slower train in 36 seconds. The length (in m) of each train is _____.
75.	A person in a train notices that he can count 21 electric poles in 60 seconds. If the electric poles are 50 m apart, then at what speed (in km/h) is the train travelling? _____
76.	A train 100 m long passes a platform at the rate of 20 m/s in 25 seconds. The length (in m) of the bridge is _____.
77.	The time (in seconds) taken for a train, 110 m long with speed 60 km/h, to pass a person who was walking at the rate of 6 km/h against the train is _____
78.	A train takes 9 seconds to cross a pole. If the speed of the train is 48 km/h, the length (in m) of the train is _____
79.	A train takes 10 seconds to cross a pole and 20 seconds to cross a platform of length 200 m. What is the length (in km) of the train? _____
80.	If the time taken by a train, which is 280 m long and runs at the rate of 60 km/h, to cross a platform is 0.5 minutes, then what is the length (in m) of the platform? _____
81.	Two trains each 200 m long move towards each other on parallel lines with speeds 20 km/h and 30 km/h, respectively. What is the time (in seconds) that elapses when they first meet until they have cleared each other? _____
82.	Two trains of lengths 0.1 km and 0.15 km are travelling in opposite directions at speeds of 75 km/h and 50 km/h, respectively. What is the time (in seconds) taken by them to cross each other? _____
83.	Two trains travel in same direction at 50 km/h and 32 km/h, respectively. A traveller in the slower train observes that 15 s elapses before the faster train completely passes him. What is the length (in m) of the faster train?
84.	A train 110 m long is running with a speed of 60 km/h. What is the time (in seconds) in which it will pass a man who starts from the engine running at the speed of 6 km/h in the direction opposite to that of the train? _____
85.	A train crosses a telegraph post in 8 seconds and a bridge 200 m long in 24 seconds. The length of the train (in km) is _____.
86.	A sailor sails a distance of 48 km along the flow of a river in 8 hours. If he takes four hours more to return the same distance then the speed (in km/h) of the flow of the river is _____
87.	A motor boat takes two hours to travel a distance of 9 km down the current and it takes 6 hours to travel the same distance against the current. What is the speed (in km/h) of the boat in still water? _____
88.	The speed of a boat in still water is 11 km/h. It can go 12 km upstream and return downstream to the engine point in 165 minutes. What is the speed (in km/h) of stream? _____
89.	A boat man rowed against a stream flowing 1.5 km/h to a certain point and then turned back, stopping 2 km short of the place from where he originally started. If the whole time occupied in rowing be 130 minutes and his uniform speed in still water be 1.25 m/s, then the man went

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	up the stream a distance (in m) of _____
90.	A boat man can row 30 km upstream and 44 km downstream in 10 hours. Also, he can row 40 km upstream and 55 km downstream in 13 hours. The rate (in km/h) of the stream is _____
91.	A man can row 8 km/h in still water. If the river is running at 2 km/h, it takes 32 minutes to row to a place and back. How far (in m) is the place? _____
92.	A man swims in a stream which flows 1.5 km/h finds that in a given time he can swim twice as far with the stream as he can against it. At what speed (in m/s) does he swim? _____
93.	A boat travels upstream from B to A and downstream from A to B in 180 minutes. If the speed of the boat in still water is 2.5 m/s and the speed of current is 3 km/h, the distance (in km) between A and B is _____
94.	A man can row a boat at the rate of 10 km/h in still water. It travelled 91 km downstream in a river and then returned, taking altogether 20 hours. At what speed (in km/h) the river was flowing? _____
95.	A man, who can swim at the rate of 0.8 m /s in still water, swims 0.2 km against the current and 0.2 km with the current. If the difference between those two times is 600 seconds, find the speed (in m/min) of the current. _____
96.	A boat man can row 0.75 km against the stream in 675 seconds and return in 450 seconds. Find the speed (in km/h) of man in still water. _____
97.	Speed of Boat A when moving in the direct perpendicular to the direction of the current is 16 km/h, speed of the current is 3 km/h. So the speed (in km/h) of boat against the current will be _____
98.	An aeroplane can travel at 320 km/h in still air. The wind is blowing at a constant speed of 40 km/h. The total time for a journey against the wing is 135 minutes. What will be the time in seconds (excluding the take-off and landing time for an aeroplane) for the return journey with the wind? _____
99.	A boat goes 24 km upstream and 28 km downstream in six hours. If goes 30 km upstream and 21 km downstream in 390 minutes. The speed (in km/h) of the current is _____.
100.	A boat whose speed is 15 km/h in still water goes 30 km downstream and comes back in 270 minutes. The speed of the stream in (km/h) is _____
101.	A boat while going downstream in a river covered a distance of 50 km at an average speed of 60 km/h. While returning because of the water resistance, it took 75 minutes to cover the same distance. What is the average speed (in km/h) during the whole journey? _____
102.	A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively? (a) 2 : 1 (b) 3 : 2 (c) 5 : 3 (d) 8 : 3
103.	A boat can travel with a speed of 13 km/h in still water. If the speed of the stream is 4 km/h, find the time (in minutes) taken by the boat to go 68 km downstream. _____
104.	A person travels on a cycle from home to church on a straight road with wind against him. He took 4 hours to reach there. On the way back to the home, he took 3 hours to reach as wind was in the same direction. If there is no wind, how much time (in minutes) does he take to travel from home to church? _____
105.	In one hour, a boat goes 11 km/h along the stream and 5 km/h against the stream. The speed of the boat in still water (in km/h) is _____.
106.	A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed (in km/h) of the boat in still water? _____
107.	The speed of a boat in still water in 15 km/h and the rate of current is 3 km/h. The distance (in km) travelled downstream in 12 minutes is _____
108.	A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed (in mph) of the stream is _____
109.	A man can row at 5 km/h in still water. If the velocity of current is 1 km/h and it takes him 1 hour to row to a place and come back, how far (in km) is the place? _____

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110.	A boat covers a certain distance downstream in 1 hour, while it comes back in 1.5 hours. If the speed of the stream be 3 km/h, what is the speed (in km/h) of the boat in still water? _____
111.	A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long (in minutes) will it take to go 5 km in stationary water? _____
112.	A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is (a) 2 : 1 (b) 3 : 1 (c) 3 : 2 (d) 4 : 3
113.	A train of length 550 m is running with speed 50 m/s in the direction of flow of river. The time taken for a train to cross a person who is driving his motorboat at the rate of 10 m/s upstream is 10 seconds. Find the time (in seconds) taken for a train to cross a person who is driving his motorboat at the rate of 6 m/s downstream. _____
114.	Thrice the speed of a boat downstream is equal to thrice the speed of upstream. The ratio of its speed in still water to speed of current is (a) 1 : 5 (b) 1 : 3 (c) 5 : 1 (d) 2 : 3

8.2 Circular Motion, Clocks and Calendars

Circular Motion: In case of motion in a straight line, we have observed that if the two bodies or persons are moving with different speeds in a straight line in same direction, then they will never meet because with the passage of time, the distance between them is increasing constantly. Circular motion is a special case of movement in which when two or more bodies are moving around a circular track. Let we have two bodies B_1 and B_2 with speeds S_1 and S_2, such that $S_1 > S_2$. So when B_1 overtakes B_2, B_1 goes ahead of B_2, and for every unit time that elapses, B_1 keeps increasing the distance by which B_2 is behind B_1. However, when the distance by which B_1 is in front of B_2 becomes equal to the circumference of the circle around which the two bodies are moving, B_1 comes in line with B_2 and thus B_2 has been overlapped by B_1. Now consider the following cases:

Case 1: When two or more bodies are running (with different speeds) around a circular track in the same direction

- **First Meeting anywhere on the track:** Let two bodies A and B with speed S_A and S_B ($S_A > S_B$), respectively, running around a circular track of distance x in same direction. Bodies A and B will be meeting for the first time only if A has taken one more round of the track than B, i.e. at the moment when the distance between them is equal to x (the circumference of the circle). So the time taken for the first meeting is $= \dfrac{\text{distance}}{\text{relative speed}} = \dfrac{x}{S_A - S_B}$.
- **First Meeting anywhere on the track:** Let three bodies A, B and C with speed S_A, S_B and S_C ($S_A > S_B > S_C$), respectively, running around a circular track of distance x, in same direction. To calculate when they will meet for the first time, we are required to find the time taken by A to take one round over the other bodies. The time taken by A to take one round over B is $t_{A-B} = \dfrac{\text{distance}}{\text{relative speed}} = \dfrac{x}{S_A - S_B}$; similarly time taken by A to take one round over C is $t_{A-B} = \dfrac{\text{distance}}{\text{relative speed}} = \dfrac{x}{S_A - S_C}$. So all A, B and C will meet first time at time $t = \text{LCM}(t_{A-B}, t_{A-C})$. It can be also noted that A, B and C will meet for 2nd, 3rd, and so on, after time $t = \text{LCM}(t_{A-B}, t_{A-C})$. Similar result also holds for more than three bodies.
- **First meeting at starting point:** Let two or more bodies with different speeds running around a circular track in same direction. To calculate when they will meet at the starting point, we are

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required to find the time taken by each individual to take one round; so all the bodies will meet at the starting point after time $t = \text{LCM}(\text{time taken by each individual to take one round})$. Let three bodies A, B and C with speed S_A, S_B and S_C, respectively, running around a circular track of distance x, in same direction. The time taken by A to take one round is $t_A = \dfrac{\text{distance}}{\text{speed}} = \dfrac{x}{S_A}$; similarly $t_B = \dfrac{\text{distance}}{\text{speed}} = \dfrac{x}{S_B}$ and $t_C = \dfrac{\text{distance}}{\text{speed}} = \dfrac{x}{S_C}$. So the bodies will meet at the starting point after time $t = \text{LCM}(t_A, t_B, t_C)$.

- **Number of different points of meeting on the circular track:** Let two bodies A and B with speeds $15\,\text{m/s}$ and $5\,\text{m/s}$, respectively, moves around a circular track of length $500\,\text{m}$, in same direction. Their 1st meet will be after a time gap of $500/(25-15) = 50\,\text{s}$. Till this time A has covered a distance of $50\times 15 = 750\,\text{m}$ from starting point (x_0); and B has covered a distance of $50\times 5 = 250\,\text{m}$ from the starting point. Now this point ($x_1 = 250\,\text{m}$) can be assumed to be the 2nd starting point. So their 2nd meet will be at a distance of $x_2 = 250\,\text{m}$ from 2nd starting point which is $x_1 = 250\,\text{m}$ from starting point x_0; or we can say that $x_2 = x_0$, as $x_2 = 250 + 250 = 500\,\text{m}$ from x_0. So, there are a total of 2 distinct meeting points on the track. **In general, total number of different meeting points on the track, when both bodies moving in same direction, is the difference of ratio of the speed of *A* and *B* in its simplest form**. The example that we considered have ratio of speeds as $15:5 = 3:1$; so the number of different meeting points is $3-1 = 2$ points.

Case 2: When two or more bodies are running (with different speeds) around a circular track in the opposite direction

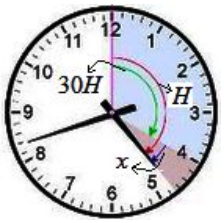
- **First Meeting anywhere on the track:** Let two bodies A and B with speed S_A and S_B ($S_A > S_B$), respectively, running around a circular track of distance x, in opposite direction. Bodies A and B will be meeting for the first time only if one round is taken by both A and B, i.e. at the moment when the distance covered by them is equal to x (the circumference of the circle). So the time taken for the first meeting is $= \dfrac{\text{distance}}{\text{relative speed}} = \dfrac{x}{S_A + S_B}$.
- **First meeting at starting point:** Let two bodies with different speeds running (in opposite direction) around a circular track of distance. To calculate when they will meet at the starting point, we are required to find the time taken by each individual to take one round; so both bodies will meet at the starting point after time $t = \text{LCM}(\text{time taken by each individual to take one round})$. Let two bodies A and with speed S_A and S_B, respectively, running around a circular track of distance x, in opposite direction. The time taken by A to take one round is $t_A = \dfrac{\text{distance}}{\text{speed}} = \dfrac{x}{S_A}$; similarly $t_B = \dfrac{\text{distance}}{\text{speed}} = \dfrac{x}{S_B}$. So both the bodies will meet at the starting point after time $t = \text{LCM}(t_A, t_B)$.
- **Number of different points of meeting on the circular track:** Let two bodies A and B with speeds $15\,\text{m/s}$ and $5\,\text{m/s}$, respectively, moves around a circular track of length $500\,\text{m}$, in opposite direction. Their 1st meet will be after a time gap of $500/(25+5) = 25\,\text{s}$. Till this time A has covered a distance of $25\times 15 = 375\,\text{m}$ from starting point (x_0); and B has covered a distance of $25\times 5 = 125\,\text{m}$ from the starting point. Now this point ($x_1 = 125\,\text{m}$) can be assumed to be the 2nd

starting point. So their 2nd meet will be at a distance of $x_2 = 125$ m from 2nd starting point which is $x_1 = 125$ m from starting point x_0; or we can say that $x_2 = 125 + 125 = 250$ m from x_0. Again their 3rd meet will be at a distance of $x_3 = 125$ m from 3rd starting point which is $x_2 = 250$ m from starting point x_0; or we can say that $x_3 = 250 + 125 = 375$ m from x_0. Again their 4th meet will be at a distance of $x_4 = 125$ m from 4th starting point which is $x_3 = 375$ m from starting point x_0; or we can say that $x_4 = 375 + 125 = 500$ m which coincide the point x_0. So, there are a total of 4 distinct meeting points on the track. **In general, total number of different meeting points on the track, when both bodies moves in opposite direction, is the sum of ratio of the speed of A and B in its simplest form**. The example that we considered have ratio of speeds as $15:5 = 3:1$; so the number of different meeting points is $3+1 = 4$ points.

Clocks: Another example of relative motion is clock problem. The problems on clocks are based on the movement of the minute (M) and hour (H) hand, which can be considered as two bodies on a circular track moving in same direction. The length of the track can be considered as 60 km $(1\,\text{min} = 1\,\text{km})$. As the speed of hour hand is $S_H = 5$ km/hr and speed of minute hand is $S_M = 60$ km/hr; so the relative speed of hour hand w.r.t. minute hand is $S_{rel} = 60 - 5 = 55$ km/hr, as both hands are moving in same direction.

- **Degree concept of Clocks:** Clock angle problems are a type of mathematical problem which involve finding the angles between the hand of an analog clock. Clock angle problems relate two different measurements: angles and time. The angle is typically measured in degrees from the mark of number 12 clockwise. The time is usually based on 12-hour clock. A method to solve such problems is to consider the rate of change of the angle in degrees per minute. The hour hand of a normal 12-hour analogue clock turns 360^o in 12 hours (i.e. 720 minutes) or 0.5^o per minute. The minute hand rotates through 360^o in 60 minutes or 6^o per minute.
- **Equation for the angle of the hour hand:** $\theta_{hr} = 30H + 0.5M$, where θ_{hr} is the angle in degrees of the hour hand measured clockwise from the 12 o'clock position; H is the hour; M is the minutes past the hour.

  Proof: The hour hand rotates at a constant rate. It starts the hour at an hour mark and after 60 minutes its position is at the next hour mark. The angle measure between these two hour marks is 30°, thus, the hour hand rotates 30° in 60 minutes. At a certain time M past the hour, the hour hand makes an angle x with its starting position, as shown in Fig.. The measure of angle x makes up a fraction $M/60\,\text{min}$ of the total angle the hour hand makes in 60 minutes. This implies that angle x is proportional to the time past the hour or $x/M = 30^o/(60\,\text{min}) \Rightarrow x = 0.5M$. Notice that if $M = 1$ min., $x = 0.5^o$. This means that the hour hand rotates 0.5° in one minute, 1° in 2 minutes, 1.5° in 3 minutes, and so forth and so on until it reaches the next hour mark in 60 minutes, i.e. it makes 30^o in 60 min. To find angle, θ_{hr}, we have to add to x the number of 30-degree angles from the 12 o'clock position clockwise to the hour hand's starting position. Thus measure of angle θ_{hr} is $\theta_{hr} = 30^o \times (\text{the number of } 30^o \text{ angles}) + \text{the measure of angle } x \Rightarrow \theta_{hr} = 30H + 0.5M$.



- **Equation for the angle of the minute hand:** $\theta_{\min} = 6M$, where $\theta_{\min}$ is the angle in degrees of the minute hand measured clockwise from the 12 o'clock position; M is the minutes.

  Proof: In 60 minutes the minute hand makes 360^o angle from the 12 o'clock position in clockwise direction. So in M minutes the angle $\theta_{\min}$ made by the minute hand from the 12 o'clock position in clockwise direction is $\theta_{\min} = \dfrac{360^o}{60} M = 6M$.

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- **Equation for the angle between the hour and minute hand:** $\Delta\theta = |\theta_{hr} - \theta_{\min}| = |30H + 0.5M - 6M| = |30H - 5.5M)|$, where $\Delta\theta$ is the angle in degrees between the hour and minute hands; H is the hour and M is the minutes past the hour.
  - It is to be noted that the hour and minute hands are superimposed only when $\Delta\theta = 0 \Rightarrow \theta_{hr} = \theta_{\min} \Rightarrow 30H + 0.5M = 6M \Rightarrow M = (60/11)H$. As H is an integer in the range 0 to 11, this gives times of: 0:00, 1:05:27, 2:10:54, and so on.
- **Number of times a clock making an angle:** We know that the hour hand rotates 360^o in 12 hours ($= 12 \times 60 = 720$ min), so in t minutes the hour hand rotates $t/2$ degrees. Also minute hand rotates 360^o in 60 min, so in t minutes the minute hand rotates $6t$ degrees. Thus in t minutes, the difference of the angles between the hour and minute hand is $6t - (t/2) = 11t/2$. Now if θ (in degrees) is the angle between hour and minute hands then $\frac{11t}{2} = n \times 360^o + \theta$, n is any integer. Thus $t = \frac{n \times 720^o + 2\theta}{11}$. Thus the minimum interval of making angle θ between them is $\frac{(m+1)720^o + 2\theta}{11} - \frac{m720^o + 2\theta}{11} = \frac{720}{11}$ minutes (putting $n = m+1$ and $n = m$). So in 12 hours, the minute and hour hand makes an angle of θ for $\frac{12\text{hr}}{(720/11)\text{ min}} = 11$ times.
  - If $\theta = 0^o$, so in 12 hours they will coincide for 11 times.
  - If $\theta = 180^o$ (i.e. diametrically opposite), so in 12 hours they will diametrically opposite for 11 times. For diametrically opposite we don't consider $\pm 180^o$, as $-180^o = 180^o$.
  - If the minute and hour hands are perpendicular the $\theta = \pm 90^o$ then in 12 hours they will make $+90^o$ for 11 times and -90^o for 11 times. Thus the minute and hour hands are perpendicular for 22 times in 12 hours.
  - A clock makes 2 right angles between any 2 hours. Note that between 2 – 4 o'clock, a total of 3 right angles formed, as at 3 o'clock one right angle is shared by between 2 – 3 and 3 – 4 o'clock. Similarly between 8 – 10 o'clock, a total of 3 right angles formed.

Example [GA-2014 (2 marks)]: At what time between 6 AM and 7 AM will the minute hand and hour hand of a clock make an angle closest to 60^o?
(a) 6:22 AM (b) 6:27 AM (c) 6:38 AM (d) 6:45 AM
Solution (a): From the given data we have $\Delta\theta = 60^o$, $H = 6$ and we have to find M. So using $\Delta\theta = |30H - 5.5M)| \Rightarrow 60 = |30 \times 6 - 5.5M| \Rightarrow \pm 60 = |30 \times 6 - 5.5M| \Rightarrow M = 21.81, 43.63$. Thus the time between 6 AM and 7 AM when the minute hand and hour hand of a clock make an angle to 60^o is 6:21.81 AM or 6:43.63 AM; after rounding off we get the time as: 6:22 AM or 6:44 AM. So the required time is 6:22 AM.

Example [GA-2016 (2 marks)]: Two and a quarter hours back, when seen in a mirror, the reflection of a wall clock without number markings seemed to show 1:30. What is the actual current time shown by the clock?
(a) 8:15 (b) 11:15 (c) 12:15 (d) 12:45
Solution (d): If the time shown by the reflection of clock is 1:30 in the mirror, then the time shown by the actual clock will be 10:30, which is the time shown two and a quarter hours back; so now the clock shows $10:30 + 2:15 = 12:45$. Thus option (d) is correct.

Calendar

- **Odd Days:** To find the day of the week on a given date, we use the concept of 'odd days'. In a given period, the number of days more than the complete weeks are called odd days.

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- **Leap Year:** A leap year has 366 days.
  - Every year which is divisible by 4 is a leap year, if it is not a century.
  - Every 4^{th} century is a leap year and no other century is a leap year. Every century which is divisible by 400 is a leap year. For e.g. the years 1948, 2004, 1676 etc. are leap years; the years 400, 800, 1200, 1600, 2000 etc. are leap years; none of the years 2001, 2002, 2003, 2005, 1800, 2100, etc. are leap years.
- **Ordinary Year:** The year which is not a leap year is called an ordinary years. An ordinary year has 365 days.
- **Days in a year**: There are 12 months in a year.
  - January, March, May, July, August, October and December are of 31 days.
  - April, June, September, November are of 30 days.
  - February is of 28 days for ordinary year and of 29 days for leap year.
- **Counting of Odd Days and weeks:**
  - $1\,\text{Ordinary year} = 365\,\text{days} = 52\,\text{weeks} + 1\,\text{day}$. Thus 1 Ordinary year has 1 odd day.
  - $1\,\text{Leap year} = 366\,\text{days} = 52\,\text{weeks} + 2\,\text{days}$. Thus 1 Leap year has 2 odd days
  - $100\,\text{Years} = 76\,\text{Ordinary days} + 24\,\text{Leap Years}$
  - $100\,\text{Years} = (76\times 1 + 24\times 2)\,\text{Odd days} = 124\,\text{Odd days} = 17\,\text{weeks} + 5\,\text{Odd days}$. Thus number of odd days in 100 years is 5 days.
  - Also, number of odd days in 200 years is $(5\times 2)\,\text{days} = 1\,\text{week} + 3\,\text{odd days}$, i.e. 3 odd days.
  - Similarly, number of odd days in 300 years is 1; and number of odd days in 400 years is 0. Thus each one of 800 years, 1200 years, 1600 years, 2000 years etc. has 0 odd days.
- **Odd days and their numeral values:** When we have to find the specific day, we denote the day as the numeral values as: $0 \to \text{Sunday};\ 1 \to \text{Monday};\ 2 \to \text{Tuesday};\ 3 \to \text{Wednesday};\ 4 \to$ Thursday, $5 \to \text{Friday},\ 6 \to \text{Saturday}$. Let us consider an example:

Example: Arun was born on 30^{th} January, 1948. What was the day on which he was born?
Solution: Up to 1600 we have 0 odd days, up to 1900 we have 1 odd day. Now for in 47 years we have 11 leap years and 36 normal years. Thus Odd days from 1901 to 1947 is $11\times 2 + 36\times 1 = 58$ odd days, i.e. 8 weeks and 2 odd days. So total odd days up to 31^{st} December 1947 is $1 + 2 = 3$ odd days. 30 days of January contain only 4 weeks + 2 odd days. Thus 30^{th} January 1948 has total 5 odd days, and 5 represents Friday. So the day on 30^{th} January 1948 was Friday.

Example: Jan 1, 1992 was Wednesday. What day of the week will it be on Jan 1, 1993?
Solution: As 1992 being a leap year it has 2 odd days. So, the required day will be two days beyond Wednesday, i.e., it will be Friday.

Exercise 8.2

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	Two cyclists start on a circular track from a given point but in opposite directions with speeds 7 m/s and 8 m/s, respectively. If the circumference of the circle is 300 m, after what time (in minutes) will they meet at the starting point? _____
2.	A person moving on a circular track of radius 98 m completes one revolution in 120 seconds. What is the approximate speed (in m/min) of the cyclist? _____
3.	A and B run a 5 km race on a round course of 0.4 km. If their speeds be in the ratio $5:4$, how often does the winner pass the other? _____
4.	There are two concentric circular tracks of radius 100 m and 102 m respectively. A runs on the inner track and goes once round the track in 90 seconds, while B runs on the other track in 92 seconds. Who runs faster? (a) A (b) B (c) Both A and B are equal (d) Data insufficient
5.	There is a ring road connecting points A, B, C and D. The road is in a complete circular form but having several approach roads leading to the centre Exactly in the centre of the ring road

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	there is a tree which is 20 km from point A on the circular road You have taken a round of circular road starting from point A and finish at the same point after touching points B, C and D. You, then drive 20 km interior towards the tree from point A and from there, reach somewhere in between B and C on the ring road. How much distance (in km) do you have to travel from the tree to reach the point between B and C on the ring road?
6.	Wheels of diameter of 7 cm and 14 cm start rolling simultaneously from A and B, which are 1980 cm apart, towards each other in opposite direction. Both of them make same number of revolutions per second. If both of them meet after 10 seconds, the speed (in cm/s) of the smaller wheel is _____.
7.	The jogging track in a sports complex is 726 m in circumference. Suman and her boyfriend start walking from the same point but in opposite direction at 4.5 km/hand 3.75 km/h, respectively. They will meet for the first time in _____ minutes.
8.	A and B start from the same point and run around a circular stadium, whose circumference is 4200 m, at the rate of 500 m/min and 700 m/min, respectively in the opposite direction. They will meet each other in _____ minutes.
9.	A person takes 30 hours to reach a destination by riding a bike whose wheel's diameter is 70 cm., at the speed of 22 km/h. How many revolutions will the wheel make during this journey? _____$\times 10^3$.
10.	Two cyclists start on a circular track from a given point but in opposite directions with speeds of 7 m/s and 8 m/s, respectively. If the circumference of the circle is 300 m after what time (in seconds) will they meet at the starting point? _____
11.	Two men A and B walk round a circular track, whose circumference is 1200 m. A walks at the rate of 2.5 m/s and B at the rate of $4/3$ m/s. If they both start in the same direction, they will first be together again at the starting point after _____ minutes.
12.	In Q.11, both A and B will be together again after _____ minutes.
13.	In a circular race course with 250 m as circumference, there is a race of 8 laps. A overlaps B at the middle of the sixth round. By what distance (in km) will A win at the same rate of running? _____
14.	There is a race of 16 laps between Rohan and Sohan on a circular field having circumference of 250 m. If their speeds are in the ratio of $5:4$, how many times the winner passes the other? _____
15.	Three friends X, Y and Z walk round a circular track of radius 280 m at the rates of 160, 120 and 105 m/min, respectively. If they all start together and walk in the same direction, when (in minutes) will they be first together again? _____
16.	Three friends X, Y and Z runs round a circular track, whose circumference is 97 m, with speeds 30, 26, 18 m/min, respectively. X starts in a direction opposite to that of Y and Z. Find the time (in minutes) when all three friends will be together for the first time after starting. _____
17.	In Q.16, find the time (in minutes) when all three friends will be together at the starting point.
18.	Three friends X, Y and Z start running around a circular track, whose circumference is x m, with speeds 5, $36/7$, $16/3$ km/h, respectively. They come back to the fixed point in 3.75 hours. Find the greatest circumference of the circular track? (a) $5/28$ km (b) $28/5$ km (c) $8/27$ km (d) $27/8$ km
19.	Two motorcyclists start a race at 5 : 00 PM, around a circular track. The first goes round once in 3.2 minutes and the second in 3.5 minutes. Find at what time they will again meet at the starting point. (a) 6 : 52 PM (b) 5 : 06 PM (c) 5 : 52 PM (d) 6 : 50 PM
20.	If P and Q are running in a circular track, whose circumference is 120m, in a direction opposite to that in which R is running, who is running at twice and thrice the speed of P and Q respectively and on the same track. They start running from the same point. If P runs at the rate of 3 m/sec, when (in seconds), after the start, will Q find himself equidistant and between P and R for the first time? _____

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21.	In Q.20, how many complete rounds made by R when all the three P, Q and R meets for the first time? _____
22.	Two runners run in the same direction along a circular track 2000 m long. The faster runner overtakes the slower one every half an hour minutes. Find the speed (in km/h) of faster runner, if the faster one completes a round 60 seconds sooner than the other. _____
23.	P and Q start from the same point to run in opposite directions round a circular path 0.55 km in length. P giving Q a start of 0.1 km. They pass each other when P has run 0.25 km. Who will come first to the starting point and at what distance will they be apart? (a) P, 10 m (b) Q, 20 m (c) Q, 10 m (d) P, 20 m
24.	Two men, P and Q start together from the same point to walk round a circular course 5 km. The speed of P and Q are 3.5, 2.75 km/h. Find when (in minutes) they meet next if they walk in the same direction. _____
25.	Three runners agree to start together and run, until all come together again, round a circular track whose circumference is 15 m. They run at the rate of six, seven and eight km/h, respectively. After how many minutes will they end their race? _____
26.	A can run one full round of a circular track in 6 min and B in 15 min. Both A and B start simultaneously from the same starting point. How many times would they met in the time B has completed 10 rounds when running in same direction? _____
27.	In Q.26, find how many times would they met in the time B has completed 10 rounds when running in opposite direction? _____
28.	A and B start running on a circular track simultaneously and in the same direction. A takes 4 min to complete one round, and B takes 7 min to complete one round. Find after how much time (in minutes) would they meet for the first time at a point diametrically opposite to the starting point on the track? (a) 28 (b) 30 (c) 32 (d) They will never meet
29.	In a circular track, there are two points P and Q which are diametrically opposite. C starts running clockwise with a speed of 4 m/s from P. At the same time, from Q, A starts running clockwise with a speed of 3 m/s and B starts running anti clockwise with a speed of 5 m/s. If the length of the track is 300 m, then after how much time (in minutes) will C be equidistant from A and B for the first time? _____
30.	Three boys A, B and C start running at constant speeds from the same point P along the circumference of a circular track. The speeds of A, B and C are in the ratio $5:1:1$. A and B run clockwise while C runs in the anticlockwise direction. Each time A meets B or C on the track he gives them a card. What is the difference in the number of cards received by B and C if A distributes 33 cards in all? _____
31.	Seven children A, B, C, D, E, F and G started walking from the same point at the same time, with speeds in the ratio of $1:2:3:4:5:6:7$ respectively and they are running around a circular park. Each of them was carry flags of different colors. Whenever two or more children meet then they place their respective flag at that point, however nobody places more than 1 flag at a same point. They are running in anti-clockwise direction. How many flags will be there in total, when there will be no scope of putting more flags? _____
32.	A clock gains 15 minutes per day. It is set right at 12 noon. What time will the clock show at 4 : 00 AM? (a) 4 : 10 AM (b) 4 : 15 AM (c) 4 : 30 AM (d) 5 : 00 AM
33.	If you look at a clock and the time is 3:15. What is the angle (in degrees) between the hour and the minute hands?
34.	At what time immediately prior to Six O'clock the hands of the clock are exactly opposite to each other. Give the exact time in hours, minutes and seconds. (a) 4 : 54 : 32 (b) 5 : 54 : 32 (c) 4 : 45 : 23 (d) 5 : 45 : 23
35.	Ashok always goes walking to the clinic and takes the same time while going and while coming back. One day he noticed something. When he left the home, the hour hand and the minute hand were exactly opposite to each other and when he reached the clinic, they were together. Similarly, when he left the clinic, the hour hand and the minute hand were together

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	and when he reached the home, they were exactly opposite to each other. How much time does Ashok take to reach home from the clinic? Give the minimal possible answer. (a) 23 minutes 53.6 seconds (b) 32 minutes 43.6 seconds (c) 23 minutes 43.6 seconds (d) 32 minutes 53.6 seconds
36.	Vinay was studying for his examinations and the lights went off. It was around 1:00 AM. He lighted two uniform candles of equal length but one thicker than the other. The thick candle is supposed to last six hours and the thin one two hours less. When he finally went to sleep, the thick candle was twice as long as the thin one. For how long (in minutes) did Vinay study in candle light? _____
37.	The minute and the hour hand of a watch meet every 65 minutes. How much time does the watch gain time (in seconds)? _____
38.	An accurate clock shows $8:00$ AM. Through how many degrees will the hour hand rotate when the clock shows $2:00$ PM? _____
39.	Find the largest angle (in degrees) between the hands of a clock at $10:25$ AM. _____
40.	A clock is started at noon. What angle (in degrees) is turned by the hour hand when for the first time the clock shows 10 minutes past 5? _____
41.	A watch which gains five seconds in three minutes was set right at $7:00$ AM. In the afternoon of the same day, when the watch indicated quarter past 4 O'clock, the true time is (a) 5 min. past 3 (b) $4:00$ PM (c) 10 min. past 4 (d) $3:00$ PM
42.	How much does a watch lose per day, if its hands coincide every 64 minutes? (a) $32\frac{8}{11}$ min (b) $35\frac{5}{11}$ min (c) $36\frac{5}{11}$ min (d) $38\frac{8}{11}$ min
43.	At what time between $7:00$ AM and $8:00$ AM, will the hands of a clock be in the same straight line but not together? (a) $5\frac{2}{11}$ min. past 7 (b) $5\frac{3}{11}$ min. past 7 (c) $5\frac{4}{11}$ min. past 7 (d) $5\frac{5}{11}$ min. past 7
44.	At what time between $5:30$ PM and $6:00$ PM will the hands of a clock be in right angles? (a) $\frac{478}{11}$ min. past 5 (b) $\frac{480}{11}$ min. past 5 (c) $\frac{481}{11}$ min. past 5 (d) $\frac{482}{11}$ min. past 5
45.	At what time between $2:00$ and $3:00$ will the hands of a clock be together? (a) $2:45$ (b) $2:40$ (c) $2:44$ (d) $\frac{120}{11}$ min. past 2
46.	At what time between $4:00$ PM and $5:00$ PM will the hands of a clock be at right angle? (a) $4:45$ (b) $4:40$ (c) $\frac{40}{11}$ min. past 4 (d) $\frac{53}{11}$ min. past 4
47.	Find the angle (in degrees) between the hour hand and the minute hand of a clock when the clock shows $3:25$. _____
48.	At what time between 5 and 6 O'clock are the hands of a clock 3 minutes apart? (a) $\frac{346}{11}$ min. past 5 (b) $\frac{347}{11}$ min. past 5 (c) $\frac{348}{11}$ min. past 5 (d) $\frac{349}{11}$ min. past 5
49.	The minute hand of a clock overtakes the hour hand at intervals of 65 minutes of the correct time. How much a day does the clock gain or lose? (a) Gains $\frac{440}{43}$ min (b) Lose $\frac{440}{43}$ min (c) Gains $\frac{443}{43}$ min (d) Lose $\frac{443}{43}$ min
50.	A watch which gains uniformly, is 6 minutes slow at $8:00$ AM on Sunday; and it is 6 min. 48 sec. on the following Sunday. When was it correct? (a) $7:20$ PM on Tuesday (b) $8:20$ AM on Tuesday (c) $8:20$ AM on Wednesday (d) $7:20$ PM on Wednesday
51.	A clock is set right at $6:00$ PM. The clock loses 16 minutes in 24 hours. What will be the true time when the clock indicates $10:00$ PM on 4^{th} day?

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	(a) 11 : 00 AM (b) 11 : 00 PM (c) 10 : 00 AM (d) 10 : 00 PM
52.	A clock is set right at 8 : 00 AM. The clock gains 10 minutes in 24 hours will be the true time when the clock indicates 1 : 00 PM on the following day? (a) 12 : 45 PM (b) 12 : 48 PM (c) 12 : 50 PM (d) 12 : 52 PM
53.	How many times are the hands of a clock at right angle in a day?
54.	Find the largest angle (in degrees) between minute hand and the hour hand of a clock when the time is 8 : 30 . _____
55.	How many times in a day, are the hands of a clock in straight line but opposite in direction? _____
56.	At what time between 3 and 4 O'clock, the both hands will coincide each other? (a) $\frac{180}{11}$ min. past 3 (b) $\frac{181}{11}$ min. past 3 (c) $\frac{184}{11}$ min. past 3 (d) $\frac{189}{11}$ min. past 3
57.	How many times do the hands of a clock coincide in a day? _____
58.	A watch which gains uniformly is two minutes slow at noon on Monday and is 4 min 48 sec fast at 2 : 00 PM on the following Monday. When was it correct? (a) 2 : 00 PM on Tuesday (b) 2 : 00 PM on Wednesday (c) 3 : 00 PM on Tuesday (d) 3 : 00 PM on Wednesday
59.	The quarter of the time from midnight to present time added to the half of the time from the present to midnight gives the present time. What is the present time? (a) 9 : 28 AM (b) 9 : 28 PM (c) 9 : 36 AM (d) 9 : 36 PM
60.	Light glows for every 13 seconds. How many times did it between 1 : 57 : 58 AM and 3 : 20 : 47 AM? _____
61.	When the actual time pass 1hr wall clock is 10 min behind it .when 1 hour is shown by wall clock, table clock shows 10 min ahead of in when table clock shows 1 hour the alarm clock goes 5 min behind it, when alarm clock goes 1 hour wrist watch is 5 min ahead of it assuming that all clocks are correct with actual time at 12 noon what will be time shown by wrist watch after 6 hour. (a) 5 : 47 : 37.5 (b) 5 : 45 : 37.5 (c) 5 : 47 : 32.5 (d) 5 : 45 : 32.5
62.	If a clock takes 7 seconds to strike 7, how long (in seconds) will the same clock take to strike 10? _____
63.	A clock strikes 6 O'clock in 5 seconds. How long (in seconds) does it take to strike 12 O'clock? _____
64.	Fifty minutes ago if it was four times as many minutes past 3 O'clock, how many minutes is it to 6 O'clock? _____
65.	It was Sunday on January 1, 2006. What was the day of the week January 1, 2010? (a) Tuesday (b) Wednesday (c) Thursday (d) Friday
66.	What was the day of the week on 28th May, 2006? (a) Sunday (b) Monday (c) Tuesday (d) Wednesday
67.	What was the day on June 17, 1998? (a) Wednesday (b) Thursday (c) Friday (d) Saturday
68.	What will be the day on 15th August, 2010? (a) Friday (b) Saturday (c) Sunday (d) Monday
69.	It today is Saturday then what is the day before 61 day? (a) Friday (b) Saturday (c) Sunday (d) Monday
70.	If 6th March, 2004 is Sunday, what was the day on 6th March, 2005? (a) Friday (b) Saturday (c) Sunday (d) Monday
71.	The date of first Wednesday of April, 2011 is _____
72.	How many days are there in n weeks and n days? (a) $7n^2$ (b) $8n$ (c) $14n$ (d) None of these
73.	The last day of a century cannot be (a) Tuesday (b) Thursday (c) Saturday (d) Any one of (a) or (b) or (c)
74.	On 8th February, 2004 it was Sunday. What was the day of the week on 8th February, 2005?

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	(a) Monday	(b) Tuesday	(c) Wednesday	(d) Thursday
75.	The calendar for the year 2018 will be same for the year:			
	(a) 2005	(b) 2006	(c) 2007	(d) 2008
76.	Which of the following is not a leap year?			
	(a) 500	(b) 800	(c) 1200	(d) 2000
77.	What was the day on 16th July, 1776?			
	(a) Monday	(b) Tuesday	(c) Wednesday	(d) Thursday
78.	What was the date on 3rd Saturday of August, 1947? _____			
79.	What was the date on 3rd Sunday of April, 2000? _____			
80.	On what date of July, 2004 the fourth Monday falls? ____			
81.	Which of the following years has same calendar for the year 1973?			
	(a) 1976	(b) 1977	(c) 1978	(d) 1979
82.	Any day in April is always on the same day of the week as the corresponding day in			
	(a) May	(b) June	(c) July	(d) August
83.	Total number of odd days in 49 years is _____.			
84.	If today is Friday then after 63 days it will be			
	(a) Tuesday	(b) Wednesday	(c) Thursday	(d) Friday
85.	If the day before two days after the day before tomorrow is Monday, what is today?			
	(a) Thursday	(b) Friday	(c) Saturday	(d) Sunday

8.3 Work, Day and Time

- If A does the work in x days, then in one day A does $\frac{1}{x}$th part of work. If B does the work in y days, then in one day B does $\frac{1}{y}$th part of work. Then in one day if both A and B work together, then their combined work will be $\frac{1}{x}+\frac{1}{y}=\frac{x+y}{xy}$th part of work; or the total work will be done by both A and B in $\frac{xy}{x+y}$ days.
- In terms of percentage, if A does the work in x days, then in one day A does $\frac{100}{x}$% of work. If B does the work in y days, then in one day B does $\frac{100}{y}$% of work. Then in one day if both A and B work together, then their combined work will be $\left(\frac{100}{x}+\frac{100}{y}\right)$% of work; or the total work will be done by both A and B in $100\Big/\left(\frac{100}{x}+\frac{100}{y}\right)=\frac{xy}{x+y}$ days.
- If A and B are working to build a wall while C is working to break the wall. In such a case, if we consider the work as the building of the wall, we can say that C is doing negative work.
- If work done is constant then $\text{Work rate}\times\text{time}=\text{Work done}$; thus work rate is inversely proportional to time.
- **Work as Volume of Work:** If m_1 person working t_1 hours a day can completely build a wall of length l_1, breadth b_1 and height h_1 in d_1 days; and m_2 person working t_2 hours a day can completely build a wall of length l_2, breadth b_2 and height h_2 in d_2 days; then we have $\frac{l_1b_1h_1}{l_2b_2h_2}=\frac{m_1t_1d_1}{m_2t_2d_2}$.

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- If A is k times as efficient as B then A does k times the work done by B in the same time. In other words, A will require $1/k^{\text{th}}$ part of the time required by B to complete the work.

Example [GA-2010 (2 marks)]: 5 skilled workers can build a wall in 20 days; 8 semi-skilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, bow long will it take to build the wall?
(a) 20 days (b) 18 days (c) 16 days (d) 15 days
Solution (d): 5 skilled workers build wall in 20 days. So 1 skilled worker build wall in 5×20 days. Thus in 1 day, part of work done by skilled worker is $1/(5\times 20)$. Similarly, in 1 day, part of work done by semi-skilled worker is $1/(8\times 25)$; and part of work done by unskilled worker is $1/(10\times 30)$. Thus in 1 day total part of work done by 2 skilled, 6 semi-skilled and 5 unskilled workers is $\frac{2}{5\times 20}+\frac{6}{8\times 25}+\frac{5}{10\times 30}=\frac{1}{15}$. So total work done by 2 skilled, 6 semi-skilled and 5 unskilled workers in $1/(1/15)=15$ days.

Example [GA-2011 (1 mark)]: If m students require a total of m pages of stationery in m days, then 100 students will require 100 pages of stationery in
(a) 100 days (b) $m/100$ days (c) $100/m$ days (d) m days
Solution (d): If m students require a total of m pages of stationery in m days, then 1 students will require 1 page of stationery in m days; and thus 100 students will require a total 100 page of stationery in m days.

Example [GA-2016 (1 mark)]: ***S***, ***M***, ***E*** and ***F*** are working in shifts in a team to finish a project. ***M*** works with twice the efficiency of others but for half as many days as ***E*** worked. ***S*** and ***M*** have 6 hour shifts in a day, whereas ***E*** and ***F*** have 12 hours shifts. What is the ratio of contribution of ***M*** to contribution of ***E*** in the project?
(a) 1 : 1 (b) 1 : 2 (c) 1 : 4 (d) 2 : 1
Solution (b): Let 'x' be the number of days for which ***M*** works in the project. As ***M*** works with twice the efficiency of others (i.e. ***S***, ***E*** and ***F***)
So contribution of ***M*** in the project is x days $\times 6$ hours $\times 2 = 12x$ days - hours.
Similarly, contribution of ***E*** in the project is $2x$ days $\times 12$ hours $\times 1 = 24x$ days - hours.
So the ratio of contribution of ***M*** to contribution of ***E*** in the project $=\frac{12x \text{ days - hours}}{24x \text{ days - hours}}=\frac{1}{2}$

Example [GA-2016 (2 marks)]: Ananth takes 6 hours and Bharath takes 4 hours to read a book. Both started reading copies of the book at the same time. After how many hours is the number of pages to be read by Ananth, twice that to be read by Bharath? Assume Ananth and Bharath read all the pages with constant pace.
(a) 1 (b) 2 (c) 3 (d) 4
Solution (c): Ananth takes 6 hours and Bharath takes 4 hours to read a book. So the number of pages read by Ananth and Bharath must be a multiple of $LCM(6,4)=12$.
Let there are 12 pages in the book. It is to be noted that we have to find 'the number of pages to be read', i.e. number of pages not read by them. Now
In one hour, Ananth reads $12/6=2$ pages; and Bharath reads $12/4=3$ pages. Thus in one hour number of pages to be read by Ananth is $12-2=10$ pages; and by Bharath is $12-3=9$ pages, which is in the ratio of $10:9$, so option (a) is not correct.

In two hours, Ananth reads $2\times(12/6)=4$ pages; and Bharath reads $2\times(12/4)=6$ pages. Thus in two hours number of pages to be read by Ananth is $12-4=8$ pages; and by Bharath is $12-6=6$ pages, which is in the ratio of $8:6\equiv 4:3$, so option (b) is not correct.

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In three hours, Ananth reads $3\times(12/6)=6$ pages; and Bharath reads $3\times(12/4)=9$ pages. Thus in three hours number of pages to be read by Ananth is $12-6=6$ pages; and by Bharath is $12-9=3$ pages, which is in the ratio of $6:3\equiv 2:1$, which is required ratio and so option (c) is correct.

Example [GA-2016 (2 marks)]: P, Q, R and S are working on a project. Q can finish the task in 25 days, working alone for 12 hours a day. R can finish the task in 50 days, working alone for 12 hours per day. Q worked 12 hours a day but took sick leave in the beginning for two days. R worked 18 hours a day on all days. What is the ratio of work done by Q and R after 7 days from the start of the project?
(a) 10 : 11 (b) 11 : 10 (c) 20 : 21 (d) 21 : 20
Solution (c): Q can finish the task in 25 days, working alone for 12 hours/day. So whole work done by Q in $25\,\text{days}\times 12\dfrac{\text{hours}}{\text{day}}=300\,\text{hours}$. Hence in one hour, Q can finish $\dfrac{1}{300}$th of the work. Similarly, R can finish the task in 50 days, working alone for 12 hours/day. So whole work done by R in $50\,\text{days}\times 12\dfrac{\text{hours}}{\text{day}}=600\,\text{hours}$. Hence in one hour, R can finish $\dfrac{1}{600}$th of the work. Now
In first 7 days, the total time of work of Q is $(7-2)\times 12=60\,\text{hours}$, so work done by Q in first 7 days is $\dfrac{60}{300}=\dfrac{1}{5}$. Similarly, In first 7 days, the total time of work of R is $7\times 18=126\,\text{hours}$; so work done by R in first 7 days is $\dfrac{126}{600}=\dfrac{21}{100}$. Hence, the ratio of work done by Q and R after 7 days from the start of the project is $\dfrac{1/5}{21/100}=\dfrac{20}{21}$. So option (c) is correct.

Pipes and Cisterns

- A pipe connected with a tank or reservoir for filling is called as **inlet**.
- A pipe connected with a tank or reservoir for empties is called as **outlet**.
- If a pipe can fill a tank in x hours, then the part filled in 1 hour is $1/x$.
- If a pipe can fill a tank in x hours, and another pipe can empty the full tank in y hours, then the net part filled in 1 hour when both the pipes are opened is $\left(\dfrac{1}{x}-\dfrac{1}{y}\right)$. Thus time taken to fill the tank when both pipes are opened is $\dfrac{xy}{y-x}$.
- If a pipe can fill a tank in x hours, and another pipe can fill it in y hours, then the net part filled in 1 hour when both the pipes are opened is $\left(\dfrac{1}{x}+\dfrac{1}{y}\right)$. Thus time taken to fill the tank when both pipes are opened is $\dfrac{xy}{x+y}$.

Example [GA-2014 (2 mark)]: It takes 30 minutes to empty a half-full tank by draining it at a constant rate. It is decided to simultaneously pump water into the half-full tank while draining it. What is the rate at which water has to be pumped in so that it gets fully filled in 10 minutes?
(a) 4 times the draining rate (b) 3 times the draining rate
(c) 2.5 times the draining rate (d) 2 times the draining rate
Solution (a): Let the volume of the tank and draining rate is V m^3 and d m^3/min., respectively. As the time taken to empty a half-full tank by draining it at a constant rate is 30 min; so we have $30=(V/2)/d\Rightarrow 60=V/d$ …(i). Now let p m^3/min. be the pumping rate of water into the half-full

tank; so actual pumping rate of water while draining is $(p-d)\,\text{m}^3/\text{min}$. As the time taken to pump a half-full tank while draining at a constant rate is 10 min.; so we have $10=(V/2)/(p-d)\Rightarrow 20=V/(p-d)$ …(ii). Now (i)/(ii) $\Rightarrow 3=(p-d)/d \Rightarrow 3d=p-d\Rightarrow p=4d$; hence the rate at which water has to be pumped in so that it gets fully filled in 10 minutes is 4 times the draining rate.

Exercise 8.3

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	15 men complete a work in 16 days. If 24 men are employed, then the time (in days) required to complete that work will be _____
2.	A, B and C can do a piece of work individually in 8, 12 and 15 days, respectively. A and B start working but A quits after working for 2 days. After this C joins B till the completion of work. In how many days will the work be completed? _____
3.	A can do a piece of work in 40 days. He starts working, but after 5 days he was fallen ill and thus stops working. Thereafter B completes this work in 21 days. How many days would A and B take to complete this working together? _____
4.	A and B together can do a piece of work in 30 days. A and B worked for 16 days and B finished the remaining work alone in 44 days. In how many days will B finish the whole work? _____
5.	A can do a piece of work in 4 days and B can complete the same work in 12 days. What is number of days required to do the same work together? _____
6.	A can do a work in 16 days. In how many days will the work be completed by B, if the efficiency of B is 60% more than that of A? _____
7.	Manisha and Arjun can do a job alone in 10 days and 12 days, respectively. Manisha starts the work and after 6 days Arjun also joins to finish the work together. For how many days did Arjun actually work on the job? (a) $2\frac{2}{11}$ (b) $2\frac{3}{11}$ (c) $2\frac{4}{11}$ (d) $2\frac{5}{11}$
8.	A is thrice as good as a workman as B and is therefore able to finish a piece of work in 40 days less than B. Find the time in which they finish the work by working together? _____
9.	Two men and one woman can complete a piece of work in 14 days, while four women and 2 men can do the same work in 8 days. If a man gets ₹ 90 per day, what should be the wages (in ₹) per day of a woman?
10.	18 men can earn ₹ 360 in 5 days. How much money (in ₹) will 15 men earn in 9 days? _____
11.	A alone would take 8 hours more to complete the job than if both A and B worked together. If B worked alone, he took 4.5 hours more to complete the job than if A and B worked together. What time (in days) would they take if both A and B worked together? _____
12.	A takes twice as much time as B to complete a work and C does it in the same time as A and B together. If all three working together can finish the work in 6 days, then the time (in days) taken by A to finish the work is _____
13.	20 workers working for five hours per day to complete a work in 10 days. If 25 workers are employed to work 10 hours per day, what is the time (in days) required to complete the work? _____
14.	A can finish a work in 15 days, B in 20 days and C in 25 days. All these three worked together and earned ₹ 4700. The share (in ₹) of C is _____.
15.	4 goats or 6 sheep can graze a field in 50 days. 2 goats and 9 sheep can graze the field in how many days? _____
16.	A 12 m long road can be dug by 18 men in 20 days. What length (in cm) of road can be dug by 12 men in 15 days? _____
17.	A, B and C can do a work in 8, 16 and 24 days, respectively. They all begin together. A continues to work till it is finished, C left after 2 days and B one day before its completion.

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	In what time (in days) is the work finished?
18.	A can complete a job in 12 days. If A and B work together, they can complete the job in $20/3$ days. B alone complete the job in _____ days.
19.	A can finish a job in 12 hours. After working for 6 hours, he took the help of a boy and finished the job in another 5 hours. The time that the boy will take alone to complete the work is _____ hours.
20.	Working together, Amit and Shikha can complete an assigned task in 20 days. However, if Amit worked alone and complete half the work then Shikha takes over the task and completes the second half of the task, the task will be completed in 45 days. How long (in days) will Amit take to complete the task if he worked alone?
21.	If 3 men and 4 boys can do a piece of work in 8 days, then 6 men and 8 boys can do the same work in how many days?
22.	A can do a piece of work in 25 days. B is 25% more efficient than A. The number of days taken by B is _____.
23.	A machine can perform 30 identical tasks in 6 hours. At that rate, what is the minimum number of machines that should be assigned to complete 80 of the tasks within 3 hours? _____
24.	A person has to finish the work in 124 days for which he employed 120 workmen. Two-third of the work was completed in 64 days. How many workmen can be reduced now without affecting the completion of the work on time? _____
25.	45 people take 18 days to complete a work. If the work is to be completed in 15 days, then how many more people will be required?
26.	A and B can do a piece of work in 10 hours. B and v can do it in 15 hours, while A and C take 12 hours to complete the work. B independently can complete the work in _____ hours.
27.	Anupam can complete a work in 10 days. Manoj is 25% more efficient than Anupam and Sonam is 60% more efficient than Manoj. Working together, how long (in days) would they take to finish the job? _____
28.	Working 7 hours daily, 24 men can complete a piece of work in 27 days. In how many days would 14 men complete the same piece of work working 9 hours daily? _____
29.	If 15 men or 24 women or 36 boys can do a piece of work in 12 days, working 8 hours a day, how many men must be associated with 12 women and 6 boys to do another piece of work 2.25 times in 30 days working 6 hours in a day? _____
30.	A stock of food is enough for 240 men for 48 days. How long (in days) will the same stock last for 160 men? _____
31.	A can do a piece of work in x days and B can do the same work in 12 days. What is the value of x? _____
32.	Machine A produces bolts at a uniform rate of 120 every 40 seconds and machine B produces bolts at a uniform rate of 100 every 20 seconds. If both machines run simultaneously, then how many seconds will it take them to produce a total of 200 bolts? _____
33.	A team of workers was employed by a contractor who undertook to finish 360 pieces of an article in a certain number of days. Making four more pieces per day that was planned, they could complete the job a day ahead of scheduled. How many days did they take to complete the job? _____
34.	A, B and C can do a piece of work individually in 8, 10 and 15 days, respectively. A and B start working but A quits after working for two days. After this C joins B till the completion of work. In how many days will the work be completed? _____
35.	The work done by a woman in 8 hours is equal to the work done by a man in 6 hours and by a boy in 12 hours. If working 6 hours per day 9 men can complete a work in 6 days, then in how many days can 12 men, 12 women and 12 boys together finish the same working 8 hours per day? _____
36.	76 women complete a job in 33 days. Due to some reason some women did not join the work and so it was completed in 44 days. The number of ladies who did not report for the work is _____

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37. How many men will be required to plough 100 acres of land in 10 days, if 10 men require 8 days to plough 20 acres of land? _____

38. A sum of ₹ 25 was paid for a work which A can do in 32 days, B in 20 days, B and C in 12 days and D in 24 days. How much did C receive if all the four work together? _____

39. A job can be done by 3 skilled workmen in 20 days or 5 boys in 30 days. How many days will they take if they work together?

40. A, B and C working together completed a job in 10 days. The ratio of their efficiency is $2:3:6$. How many days would be required by the faster worker to complete the entire work? _____

41. A completes a job in 2 days and B completes it in 3 days and C takes 4 days to complete it. If they work together and get ₹ 3900 for the job, then how much amount (in ₹) does B get? _____

42. In a village, x men had enough food to last for 30 days. After 10 days, 50 more men joined them. If the food now lasted for 16 days, what is the value of x? _____

43. 8 boys and 12 men completes a certain piece of work in 9 days. If each boy takes twice the time taken by a man to finish the work, 12 men will finish the same work in _____ days.

44. If 15 men or 24 women or 36 boys can do a piece of work in 12 days, working 8 hours a day, how many men must be associated with 12 women and 6 boys to do another piece of work 2.25 times as great in 30 days working 6 hours a day? _____

45. If 6 men and 8 boys can do a piece of work in 10 days while 26 men and 48 boys can do the same in 2 days, what is the time taken by 15 men and 20 boys in doing the same type of work? _____

46. A person walks a distance in 114 days, when he rests 9 hours a day. How long (in days) will he take to walk twice the distance, if he walks twice as fast and rests twice as long each day as before? _____

47. If one man or two women or three boys can do a piece of work in 55 days, then one man, one woman and one boy will do it in how many days? _____

48. If m men can do a job in p days, then r men can do the job in how many days?

(a) $(p+r)$ (b) $mp/(m+r)$ (c) $p/(m+r)$ (d) $(m+r)/p$

49. A can do a piece of work in 6 days and B can finish the same work in 12 days. How much work will be finished, if both work together for two days?

(a) One-fourth of the total work (b) One-third of the total work
(c) Half of the total work (d) Whole of the work

50. A can finish a work in 8 days and B can do it in 12 days. After A had worked for 3 days, B also joins A to finish the remaining work. In how many days will the remaining work be finished? _____

51. If 18 men earn ₹ 1440 in 5 days, how many men can earn ₹ 1920 in 8 days? _____

52. A certain length of pathway has to be constructed. It is found that three men can construct 1 km less than one-fifth of all in 2 days, while 18 men can construct 1 km more than two-fifth in one day. The length of the path is _____ km.

53. Two loading machines each working 12 hours per day for 8 days handle 9000 tonnes of material with an efficiency of 90%; while 3 other loading machines at an efficiency of 80% are set to handle 12000 tonnes of material in 6 days. Find how many hours per day each should work? _____

54. If 36 men can dig a trench 200 m long, 3 m wide and 2 m deep in 6 days working 10 hours a day, in how many days, working 8 hours a day will 10 men dig a trench 100 m long, 4 m wide and 3 m deep? _____

55. Bhawna alone would take 8 hours more to complete the job than when Bhawna and Ritu worked together. If Ritu worked alone, she would take 4.5 hours more to complete the job than when Bhawna and Ritu worked together. What time (in days) would they take if both Bhawna and Ritu worked together? _____

56. Five painters can pain a wall 100 m long in 10 days of 8 hours each. How many days of 6 hours each will it take for 8 men to paint a wall 30 m long? _____

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57. There are two types of workers: type I and type II. A type I worker can finish a piece of work in $2m$ per 3 hours and a type II worker can finish in m hours. If one worker of type I and two worker of type II are employed, the work can be finished in how many hours?
(a) $2m/7$ hours (b) $9m/2$ hours (c) $7m/2$ hours (d) $2m/9$ hours

58. Two men undertake to do a piece of work for ₹ 600. One alone could do it in 6 days and the other in 8 days. With the assistance of a boy, they finish it in 3 days. The boy's share (in ₹) must be _____.

59. 15 men can complete a work in 210 days. They started the work but at the end of 10 days 15 additional men, with double efficiency, were inducted. How many days in all did they take to finish the work? _____

60. 4 men and 10 women were put on a work. They completed $1/3$ of the work in 4 days. After this 2 men and 2 women were increased. They completed $2/9$ more of the work in 2 days. If the remaining work is to be completed in 3 days, then how many more women must be increased?

61. C is twice efficient as A. B takes thrice as many days as C. A takes 12 days to finish the work alone. If they work in pairs (i.e. AB, BC, CA) starting with AB on the first day, BC on the second day and AC on the third day and so on, then how many days are required to finish the work? _____

62. A can build up a wall in 8 days while B can break it in 3 days. A has worked for 4 days and then B joined to work with A for another 2 days only. In how many days will A alone build up the remaining part of the wall?

63. A certain job was assigned to a group of men to did it in 20 days. But 12 men did not turn up for the job and the remaining men did the job in 32 days. The original number of men in the group was _____.

64. Ram is twice as good workman as Shyam and finished a piece of work in 3 hours less than Shyam. In how many hours they together could finish that piece of work? _____

65. A certain rank can be filled by pipes A and B separately in 4 and 5 minutes respectively, whereas pipe C can empty in 3 minutes. How long (in minutes) will it take to fill or empty the $4/5^{th}$ full tank, if all the three pipes start together?

66. When the waste pipe is closed, two taps can separately fill a cistern in 10 and 12 minutes, respectively. When the waste pipe is opened they together fill it in 15 minutes. How long (in seconds) does it take the waste pipe to empty the cistern, when the taps are closed? _____

67. Two pipes A and B can fill a water tank in 20 and 25 minutes respectively and third pipe C can empty at the rate of 3 litres per minute. If A, B and C opened together filled the tank in 15 minutes, the capacity of the tank is _____ litres.

68. Two pipes can fill a tank in 8 hours and 12 hours, respectively, whereas an escape pipe can empty it in 6 hours. If the three pipes are opened at 1:00 PM, 2:00 PM and 3:00 PM, respectively, at what time will the tank be filled?
(a) 8:00 AM (b) 7:00 AM (c) 5:00 AM (d) 9:00 AM

69. Two pipes A and B can fill a cistern in 3 and 6 minutes, respectively, while an empty pipe R can empty the cistern in 4 minutes. All the three pipes are opened together and after 2 minutes pipe R is closed. Find when (in minutes) the tank will be full? _____

70. There is a leak in the bottom of a cistern. Before the leak, it could be filled in 4.5 hours. It now takes 30 minutes longer. If the cistern is full, in how much time (in hours) would the leakage empty the full cistern? _____

71. Two filling pipes A and B can fill a tank in 30 hours and 20 hours, respectively. Pipe B alone is kept open for half the time and both pipes are kept open for the remaining time. In how many hours, will the tank be completely full? _____

72. Two pipes A and B can fill a tank in 20 and 30 hours, respectively. Both the pipes are opened to fill the tank but when the tank is one-third full, a leak develops in the tank through which one-fourth water supplied by both pipes goes out. What is the total time (in hours) taken to fill the tank? _____

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73. A tank is filled by three pipes with uniform flow. The first two pipes operating simultaneously full the tank in the same time during which the tank is filled by the third pipe alone. The second pipe fills the tank 5 hours faster than the pipe and 4 hours slower than the third pipe. The time (in hours) required by the first pipe is _____

74. A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3. The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it need to fill it. What is the filling capacity (in m^3/min) of the pump? _____

75. Two pipes can fill a tank in 10 hours and 15 hours respectively. However, leakage at the bottom of the tank delays the filling of the tank by 3 hours when both the pipes are open simultaneously. How much time (in hours) would the leak take to empty the full cistern? _____

76. Two pipes can fill a cistern in 15 minutes and 18 minutes, respectively. Both the pipes are operating together, but 3 minutes before the cistern is full, the first pipes is closed. The cistern will be filled now in _____ minutes.

77. Two taps A and B can fill a cistern in 12 minutes and 15 minutes, respectively. They are opened together but after a few minutes, A is turned off and the rest of the cistern is filled by B in 5 minutes. After how many minutes was A turned off? _____

78. Three pipes A, B and C can fill a tank in 20 minutes, 10 minutes and 30 minutes, respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions x, y and z, respectively. The proportion of solution y in the liquid in the tank after 3 minutes is

(a) $6/11$ (b) $7/11$ (c) $8/11$ (d) $5/11$

79. Three taps A, B and C can fill a tank in 12, 15 and 20 hours, respectively. If A is open all the time and B and C are open for one hour each alternatively, the tank will be filled in _____ hours.

80. In what time (in minutes) would a cistern be filled by three pipes whose diameters are 2 cm, 3 c, and 4 cm running together, when the largest alone can fill it in 50 minutes? The amount of water flowing in each pipe is proportional to the square of its diameter? _____

81. A cistern has 3 pipes A, B and C. A and B running alone can fill it up in 2 hours and 3 hours, respectively, while C is a waste pipe. If all the 3 pipes be opened at once, 7.24 of the cistern will be filled up in 30 minutes. In what time (in hours) can C empty the full cistern? _____

82. One fill pipe A is 3 times faster than second fill pipe B and takes 32 minutes less than the fill pipe B. When (in minutes) will the cistern be full if both pipes are opened together?

83. A cistern can be filled by two pipes filling separately in 12 and 16 minutes, respectively. Both pipes are opened together for a certain time but being clogged, only $7/8$ of full quantity water flows through the former and only $5/6$ through the latter pipe. The obstructions, however, being suddenly removed, the cistern is filled in 3 minutes from that moment. How long (in minutes) was it before the full flow began? _____

84. A cistern has a leak which would empty it in 8 hours. A tap is turned on which admits 6 litres a minute into the cistern and it is now emptied in 12 hours. How many litres of liquid the cistern can hold? _____

85. A bath tub can be filled by a cold water pipe in 20 minutes and by a hot water pipe in 30 minutes. A person leaves the bathroom after turning on both pipes simultaneously and returns at the moment when the bath tub should be full. Finding, however, that the waste pipe has been open, he now closes it. In 3 minutes more the bath tub is full. In what time (minutes) would the waste pipe empty it? _____

86. Six pipes are fitted to a water tank. Some of these are inlet pipes and the others are outlet pipes. Each inlet pipe can fill the tank in 9 hours and each outlet pipe can empty the tank in 6 hours. On opening all the pipes, an empty tank is filled in 9 hours. The number of outlet pipes is _____

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87.	A ship 55 km from the shore springs a leak which admits 2 tonnes of water in 6 minutes, 80 tonnes would suffice to sink her, but the pumps can throw out 12 tonnes an hour. The average rate of sailing that she may just reach the shore as she begin to sink is _____ km/h.
88.	A, B and C are pipes attached to a cistern. A and B can fill it in 20 and 30 minutes, respectively, while C can empty it in 15 minutes. If A, B and C be kept open successively for one minute each, how soon (in minutes) will the cistern be filled? _____
89.	Two pipes P and Q would fill a cistern in 24 and 32 minutes, respectively. Both pipes are kept open. When (in minutes) should the first pipe be turned off so that the cistern may be just filled in 16 minutes? _____
90.	Two taps can fill a tank in 20 minutes and 30 minutes, respectively. There is an outlet tap at exactly half level of that rectangular rank which can pump out 100 litres of water per minute. If the outlet tap is open, then it takes 24 minutes to fill an empty tank. What is the volume (in litres) of the tank? _____
91.	A cistern can be filled by two pipes filling separately in 12 and 16 minutes, respectively. Both pipes are opened together for a certain time but being clogged, only seven-eighth of the full quantity of water flows through the former and only five-sixth through the latter pipe. The obstructions, however, being suddenly removed, the cistern is filled in 3 minutes from that moment. How long (in minutes) was it before the full flow began? _____
92.	A pipe can fill a tank in 15 minutes and another one in 10 minutes. A third pipe can empty the tank in 5 minutes. The first two pipes are kept open for 4 minutes in the beginning and then the third pipe is also opened. In what time (in minutes) will the tank be emptied?
93.	A tap can fill a tank in 16 minutes and another can empty it in 8 minutes. If the tank is already half full and both the taps are opened together, will the tank be filled or emptied? How long will it take before the tank is either filled or emptied completely as the case may be? (a) Emptied, 16 min (b) Filled, 8 min (c) Emptied, 8 min (d) Filled, 16 min
94.	One-third of the contents of a container evaporated on the first day. Three-fourth of the remaining evaporated on the second day. What part of the content of the container is left at the end of the second day? (a) One-fourth (b) Half (c) One-eighteenth (d) One-sixth
95.	Pipes A and B can fill a tank in 5 and 6 hours, respectively. Pipe C can empty it in 12 hours. The tank is half full. All the three pipes are in operation simultaneously. After how much time (in hours) the tank will be full? _____
96.	A swimming pool is 70 m long, 44 m wide and 3 m deep is filled by water flowing from a pipe at the rate of 30800 cm^3/s. The time taken to fill the swimming pool is (a) $71/2$ hours (b) 80 hours (c) $250/2$ hours (d) $250/3$ hours
97.	Grass in lawn grows equally thick and in a uniform rate. It takes 24 days for 70 cows and 60 days for 30 cows to eat the whole of the grass. How many cows are needed to eat the grass in 96 days? _____

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Answer Keys

Answer Keys: Exercise: 8.1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
180	12	4.5	6	105	c	6.5	72	480	8	3	20	420	60	200
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
40	8	300	12.5	132	750	5	25	260	58	2	a	15	30	56
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
132	3600	8	b	525	420	40	36	0.4	15	c	3	10	420	a
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
309.7	2750	120	60	41.45	d	30	48	300	1	540	11	a	120.71	20
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
40	22.5	0.4	0.4	12.5	25	240	136.8	15	2	0.8	a	64	50	60
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
400	6	120	0.2	220	28.8	7.2	75	6	0.1	1	3	5	5000	3
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
2000	1.25	12	3	32	5	10	6300	4	5	48	d	240	205.7	8
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**						
6	3.6	2	2.4	15	75	b	5	c						

Answer Keys: Exercise: 8.2

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
5	308	2.5	c	20	66	5.28	3.5	300	300	120	17.14	0.364	3	352
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
12.12	48.5	a	a	17.14	6	24	a	400	0.9	15	35	d	0.5	7
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
56	a	7.5	a	b	180	27.16	180	197.5	155	b	a	d	b	d
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
c	47.5	a	a	d	b	b	44	285	22	a	22	b	d	384
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
c	10.5	11	26	d	a	a	c	b	d	6	b	d	b	c
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**					
a	b	16	16	26	d	c	5	c	d					

Answer Keys: Exercise: 8.3

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
10	5.89	15	60	3	10	a	15	60	540	6	36	4	1200	25
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
600	5	15	60	60	4	20	6	56	9	24	2.35	36	8	72
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
16	25	10	5.3	1.5	19	40	5.33	12	20	1200	200	12	8	4
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
285	30	b	c	3	15	20	16	27	6	2.5	a	75	76.67	8
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
5.11	7.33	32	2	6.86	514	120	c	3	45	15	14.67	15	50	18
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
9.82	4.44	a	7	32	4	12	4.5	8640	48	2	5.5	167	12	1800
91	**92**	**93**	**94**	**95**	**96**	**97**								
4.5	20	c	d	1.785	d	20								

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Chapter 9 : Quadratic Equations, Inequalities and Modulus, Powers and Roots, Logarithms, Functions

9.1 Quadratic Equations

The theory of quadratic equations was already covered in section 0.2 of Engineering Mathematics. Let us consider some example:

Example [GA-2011 (2 marks)]: A student attempted to solve a quadratic equation in x twice. However, in the first attempt, he incorrectly wrote the constant term and ended up with the roots as $(4,3)$. In the second attempt, he incorrectly wrote down the coefficient of x and got the roots as $(3,2)$. Based on the above information, the roots of the correct quadratic equation are

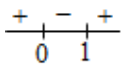
(a) $(-3,4)$ (b) $(3,-4)$ (c) $(6,1)$ (d) $(4,2)$

Solution (c): A quadratic equation whose roots are $(4,3)$ is $(x-4)(x-3)=0 \Rightarrow x^2-7x+12=0$; and a quadratic equation whose roots are $(3,2)$ is $(x-3)(x-2)=0 \Rightarrow x^2-5x+6=0$. Let the correct quadratic equation be $x^2+ax+b=0$. In the 1st attempt, let the incorrect constant term be b', so $x^2+ax+b'=0 \equiv x^2-7x+12=0 \Rightarrow a=-7$; and in the 2nd attempt let the incorrect coefficient of x be a', so $x^2+a'x+b=0 \equiv x^2-5x+6=0 \Rightarrow b=6$. Thus the correct quadratic equation is $x^2-7x+6=0$, whose roots are $(6,1)$.

Example [GA-2013 (2 marks)]: The set of values of p for which the roots of the equation $3x^2+2x+p(p-1)=0$ are of opposite sign is

(a) $(-\infty,0)$ (b) $(0,1)$ (c) $(1,\infty)$ (d) $(0,\infty)$

Solution (b): Let α, β are the roots of the given quadratic equation, so the roots are of opposite sign is the product of the roots is less than zero i.e., $\alpha\beta<0 \Rightarrow p(p-1)<0$. So from wavy curve method, we have $p \in (0,1)$.



Example [GA-2016 (2 marks)]: If $f(x)=2x^7+3x-5$, which of the following is a factor of $f(x)$?

(a) (x^3+8) (b) $(x-1)$ (c) $(2x-5)$ (d) $(x+1)$

Solution (b): If we put $x=1$ then we have $f(x)=2(1)^7+3(1)-5=0$, so $(x-1)$ is a factor of $f(x)=2x^7+3x-5$. Hence option (b) is correct.

Example [GA-2016 (1 mark)]: In a quadratic function, the value of the product of the roots (α,β) is 4. Find the value of $\dfrac{\alpha^n+\beta^n}{\alpha^{-n}+\beta^{-n}}$

(a) n^4 (b) 4^n (c) 2^{2n-1} (d) 4^{n-1}

Solution (b): $\dfrac{\alpha^n+\beta^n}{\alpha^{-n}+\beta^{-n}}=\dfrac{\alpha^n+\beta^n}{(1/\alpha^n)+(1/\beta^n)}=\dfrac{\alpha^n+\beta^n}{(\alpha^n+\beta^n)/(\alpha^n\beta^n)}=(\alpha^n\beta^n)=(\alpha\beta)^n=4^n \quad [\because \alpha\beta=4]$

Please note that the exercise on 'Quadratic Equation' is already given in chapter 0 of section 0.1 of 'Engineering Mathematics' section, as it is a common topic on Engineering Mathematics and General Aptitude.

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9.2 Inequalities and Modulus

The theory of inequalities and modulus was already covered in section 0.1 and 2.2, respectively, of Engineering Mathematics. Let us consider some example:

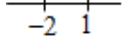
Example [GA-2011 (2 marks)]: Given that $f(y)=|y|/y$, q is any non-zero real number, the value of $|f(q)-f(-q)|$ is

(a) 0 (b) –1 (c) 1 (d) 2

Solution (d): $|f(q)-f(-q)|=\left|(|q|/q)-(|-q|/(-q))\right|=|(q/q)-(q/(-q))|=|1+1|=2$

Example [GA-2011 (2 marks)]: If $(2y+1)/(y+2)<1$, then which of the following alternatives gives the correct range of y?

(a) $-2<y<2$ (b) $-2<y<1$ (c) $-3<y<1$ (d) $-4<y<1$

Solution (b): $\frac{2y+1}{y+2}<1\Rightarrow\frac{2y+1}{y+2}-1<0\Rightarrow\frac{2y+1-y-2}{y+2}<0\Rightarrow\frac{y-1}{y+2}<0$ so from 

wavy curve method we have $y\in(-2,1)$.

Example [GA-2011 (2 marks)]: The number of solutions for the following system of inequalities: $X_1\ge 0$, $X_2\ge 0$, $X_1+X_2\le 10$, $2X_1+2X_2\ge 22$, is

(a) 0 (b) infinite (c) 1 (d) 2

Solution (a): Let $X_1\ge 0$, $X_2\ge 0$, $X_1+X_2\le 10$, $2X_1+2X_2\ge 22\Rightarrow X_1+X_2\ge 11$; as we cannot have any value of X_1 and X_2 whose sum is simultaneously ≤ 10 and ≥ 11. Thus we have no solutions.

Example [GA-2013 (1 mark)]: If $3\le X\le 5$ and $8\le Y\le 11$, then which of the following options is TRUE?

(a) $3/5\le X/Y\le 8/5$ (b) $3/11\le X/Y\le 5/8$ (c) $3/11\le X/Y\le 8/5$ (d) $3/5\le X/Y\le 8/11$

Solution (b): $3\le X\le 5$ ...(i); $8\le Y\le 11\Rightarrow\frac{1}{11}\le\frac{1}{Y}\le\frac{1}{8}$ …(ii). So (i)×(ii) $\Rightarrow\frac{3}{11}\le\frac{X}{Y}\le\frac{5}{8}$.

Example [GA-2013 (2 marks)]: If $|-2X+9|=3$ then the possible value of $|-X|-X^2$ would be

(a) 30 (b) –30 (c) –42 (d) 42

Solution (b): $|-2X+9|=3\Rightarrow -2X+9=\pm 3\Rightarrow X=(-9\pm 3)/(-2)=3,6$. So for $X=3$, we have $|-X|-X^2=|-3|-3^2=3-9=-6$; and for $X=6$, we have $|-X|-X^2=|-6|-6^2=6-36=-30$.

Example [GA-2013 (2 marks)]: X and Y are two positive real numbers such that $2X+Y\le 6$ and $X+2Y\le 8$. For which of the following values of (X,Y) the function $f(X,Y)=3X+6Y$ will give maximum value?

(a) $(4/3,10/3)$ (b) $(8/3,20/3)$ (c) $(8/3,10/3)$ (d) $(4/3,20/3)$

Solution (a): $2X+Y\le 6$ …(i); $X+2Y\le 8$ …(ii).
(i)×2 $\Rightarrow 4X+2Y\le 12\Rightarrow 3X+X+2Y\le 12\Rightarrow 3X+8\le 12\Rightarrow X\le 4/3$; similarly
(ii)×2 $\Rightarrow 2X+4Y\le 16\Rightarrow 2X+Y+3Y\le 16\Rightarrow 6+3Y\le 16\Rightarrow Y\le 10/3$. So we have $X\le 4/3$, which is not true for option (b), (c); and $Y\le 10/3$, which is not true for option (d). Thus option (a) is correct.

Example [GA-2013 (2 marks)]: If $|4X-7|=5$ then the values of $2|X|-|-X|$ is

(a) $2,1/3$ (b) $1/2,3$ (c) $3/2,9$ (d) $2/3,9$

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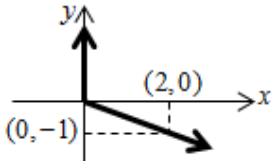
Solution (b): $|4X-7|=5 \Rightarrow 4X-7=\pm 5 \Rightarrow X=(7\pm 5)/4=3,1/2$.
So for $X=3$, we have $2|X|-|-X|=2|3|-|-3|=2\times 3-3=3$; and
for $X=1/2$, we have $2|X|-|-X|=2|1/2|-|-1/2|=1-1/2=1/2$.

Example [GA-2014 (1 mark)]: The roots of $ax^2+bx+c=0$ are real and positive. a, b and c are real. Then $ax^2+b|x|+c=0$ has
(a) no roots (b) 2 real roots (c) 3 real roots (d) 4 real roots
Solution (d): As the roots are real and a, b and c are real, so the discriminant of the given quadratic equation $ax^2+bx+c=0$ is $D\geq 0 \Rightarrow b^2-4ac\geq 0$ …(i). Now for the equation $ax^2+b|x|+c=0$, we have: for $x>0$, $ax^2+bx+c=0$ …(ii) and for $x<0$, $ax^2-bx+c=0$ …(iii). Equation (ii) is same as the given equation so from equation (ii) we have two real roots. The discriminant of (iii) is $D=b^2-4ac\geq 0$ [from (i)], so equation (iii) has two real roots. Thus for $ax^2+b|x|+c=0$, we have total 4 real roots.

Example [GA-2014 (2 marks)]: If x is real and $|x^2-2x+3|=11$, then possible values of $|-x^3+x^2-x|$ include
(a) 2, 4 (b) 2, 14 (c) 4, 52 (d) 14, 52
Solution (d): $|x^2-2x+3|=11 \Rightarrow x^2-2x+3=\pm 11 \Rightarrow x^2-2x-8=0$ and $x^2-2x-14=0$. For $x^2-2x-8=0 \Rightarrow x=4,-2$ and for $x^2-2x-14=0 \Rightarrow x=1\pm\sqrt{15}$. Now for $x=4$, $|-x^3+x^2-x|=|-4^3+4^2-4|=52$; for $x=-2$, $|-x^3+x^2-x|=|-(-2)^3+(-2)^2-(-2)|=14$.

Example [GA-2014 (1 mark)]: In which of the following options will the expression $P<M$ be definitely true?
(a) $M<R>P>S$ (b) $M>S<P<F$ (c) $Q<M<F=P$ (d) $P=A<R<M$
Solution (d): In option (a) and (b) we may or may not have $P<M$. In option (c) we have $P>M$. In option (d) we have $P<M$.

Example [GA-2015 (2 marks)]: Choose the most appropriate equation for the function drawn as a thick line, in the plot below.



(a) $x=y-|y|$ (b) $x=-(y-|y|)$
(c) $x=y+|y|$ (d) $x=-(y+|y|)$

Solution (b): From the given figure we have $y=\begin{cases}\text{any value}, & x=0\\ -x/2, & x>0\end{cases}$. Now for option (a), at $x=0$, we have $0=y-|y| \Rightarrow y=|y| \Rightarrow \pm y=y \Rightarrow y$ can take any value or zero, so first criteria is satisfied; at $x>0$, $y-|y|>0 \Rightarrow y>|y| \Rightarrow y>y$ (which is not true) if $y>0$, and $y>-y \Rightarrow y>0$ if $y<0$ which contradicts, so second criteria is not satisfied and thus the equation in option (a) is not correct. Now for option (b), at $x=0$, we have $0=-(y-|y|) \Rightarrow y=|y| \Rightarrow \pm y=y \Rightarrow y$ can take any value or zero, so first criteria is satisfied; at $x>0$, $-(y-|y|)>0 \Rightarrow y-|y|<0 \Rightarrow y<|y| \Rightarrow y<y$ (which is not true) if $y>0$, and $y<-y \Rightarrow y<0$ if $y<0$ and thus we get $y<0$ is $x>0$ so second criteria is satisfied and thus the equation in option (b) is correct. Similar arguments also hold for the options (c) and (d) to be incorrect.

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Please note that the exercise on 'Inequalities and Modulus' is already given in chapter 0 of section 0.1 of 'Engineering Mathematics' section, as it is a common topic on Engineering Mathematics and General Aptitude.

9.3 Indices and Surds

Indices: If a is any non-zero real or imaginary number and m is the positive integer, then $a^m = a \cdot a \cdot a \cdot \cdots \cdot a$ (m times). Here a is called the base and m the index, power or exponent. The basic results for indices are as follows:

- $a^0 = 1,\ a \neq 0$
- $a^{-m} = 1/a^m, (a \neq 0)$
- $(a^m)^n = a^{mn}$
- $a^{m+n} = a^m \cdot a^n$, where m and n are rational numbers
- $a^{m-n} = a^m / a^n$, where m and n are rational numbers, $a \neq 0$
- $a^{p/q} = \sqrt[q]{a^p}$
- If $x = y$, then $a^x = a^y$, but the converse may not be true. For example: $(1)^6 = (1)^8$, but $6 \neq 8$
  - If $a \neq \pm 1$, or 0, then $x = y$
  - If $a = 1$, then x, y may be any real number
  - If $a = -1$, then x, y may be both even or both odd
  - If $a = 0$, then x, y may be any non-zero real number
- $a^m \cdot b^m = (ab)^m$ is not always true. In real domain, $\sqrt{a}\sqrt{b} = \sqrt{(ab)}$, only when $a \geq 0, b \geq 0$. In complex domain, $\sqrt{a} \cdot \sqrt{b} = \sqrt{(ab)}$, if at least one of a and b is positive.
- If $a^x = b^x$ then consider the following cases:
  - If $a \neq \pm b$, then $x = 0$
  - If $a = b \neq 0$, then x may have any real value
  - If $a = -b$, then x is even.

Surds: Any root of a number which cannot be exactly found is called a surd. Let a be a rational number and n is a positive integer. If the n^{th} root of x, i.e. $x^{1/n}$ is irrational, then it is called surd of order n. **Order** of a surd is indicated by the number denoting the root. For example $\sqrt{7}, \sqrt[3]{9}, (11)^{3/5}, \sqrt[n]{3}$ are surds of second, third, fifth and n^{th} order respectively. A second order surd is often called a quadratic surd, a surd of third order is called a cubic surd. It is to be noted that if a is not rational, $\sqrt[n]{a}$ is not a surd. For example, $\sqrt{(5+\sqrt{7})}$ is not a surd as $5+\sqrt{7}$ is not a rational number.

Example [GA-2012 (1 mark)]: If $(1.001)^{1259} = 3.52$ and $(1.001)^{2062} = 7.85$ then $(1.001)^{3321} =$
(a) 2.23 (b) 4.33 (c) 11.37 (d) 27.64

Solution (d): We know that $a^b \times a^c = a^{(b+c)}$. Thus $(1.001)^{1259} \times (1.001)^{2062} = 3.52 \times 7.85$ $\Rightarrow (1.001)^{(1259+2062)} = 27.632 \Rightarrow (1.001)^{3321} = 27.632 \simeq 27.64$.

Example [GA-2016 (2 marks)]: If $q^{-a} = 1/r$ and $r^{-b} = 1/s$ and $s^{-c} = 1/q$, the value of abc is ____.
(a) $(rqs)^{-1}$ (b) 0 (c) 1 (d) $r+q+s$

Solution (c): $q^{-a} = 1/r \Rightarrow r = q^a$ …(i); $r^{-b} = 1/s \Rightarrow s = r^b$ …(ii); $s^{-c} = 1/q \Rightarrow q = s^c$ …(iii).
From (ii) and (iii), we get $q = s^c = (r^b)^c = r^{bc}$ …(iv).
From (i) and (iv), we get $r = q^a = (r^{bc})^a = r^{abc} \Rightarrow r = r^{abc} \Rightarrow abc = 1$. So option (c) is correct.

Exercise 9.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

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1. For $x \neq 0, \left(x^l/x^m\right)^{(l^2+lm+m^2)} \left(x^m/x^n\right)^{(m^2+nm+n^2)} \left(x^n/x^l\right)^{(n^2+nl+l^2)} =$

(a) 1 (b) x (c) Does not exist (d) None of these

2. If $2^x = 4^y = 8^z$ and $xyz = 288$, then $\{1/(2x)\} + \{1/(4y)\} + \{1/(8z)\} =$

(a) $11/48$ (b) $11/24$ (c) $11/8$ (d) $11/96$

3. $(2.3^{n+1} + 7 \cdot 3^{n-1})/(3^{n+2} - 2(1/3)^{1-n}) =$ _____

4. If $(2/3)^{x+2} = (3/2)^{2-2x}$, then $x =$ _____

5. The equation $4^{(x^2+2)} - 9 \cdot 2^{(x^2+2)} + 8 = 0$ has the solution

(a) $x = \pm 1$ (b) $x = \pm 2$ (c) $x = \pm\sqrt{2}$ (d) $x = \pm\sqrt{3}$

6. If $x = \sqrt[3]{(\sqrt{2}+1)} - \sqrt[3]{(\sqrt{2}-1)}$; then $x^3 + 3x =$ _____

7. $(x^5)^{1/3}(16x^3)^{2/3}\left((1/4)x^{4/9}\right)^{-3/2} =$

(a) $(x/4)^3$ (b) $(4x)^3$ (c) $8x^3$ (d) None of these

8. If $a^{1/x} = b^{1/y} = c^{1/z}$ and $b^2 = ac$ then $x + z =$

(a) y (b) $2y$ (c) $2xyz$ (d) None of these

9. If $a^x = bc, b^y = ca, c^z = ab$, then $xyz =$

(a) 0 (b) 1 (c) $x + y + z$ (d) $x + y + z + 2$

10. If $a^x = (x+y+z)^y$, $a^y = (x+y+z)^z$, $a^z = (x+y+z)^x$, then

(a) $x = y = z = a/3$ (b) $x + y + z = a/3$ (c) $x + y + z = 0$ (d) None of these

11. If $\left\{(2^{n+1})^m (2^{2n}) 2^n\right\} / \left\{(2^{m+1})^n 2^{2m}\right\} = 1$, then $m =$

(a) 0 (b) 1 (c) n (d) $2n$

12. If $x^y = y^x$, then $(x/y)^{(x/y)} = x^{(x/y)-k}$, where $k =$

(a) 0 (b) 1 (c) –1 (d) None of these

13. If $a^x = b^y = (ab)^{xy}$, then $x + y =$ _____.

14. If $x = 2^{1/3} - 2^{-1/3}$, then $2x^3 + 6x =$ _____.

15. If $x = 2 + 2^{2/3} + 2^{1/3}$, then the value of $x^3 - 6x^2 + 6x$ is _____.

16. If $4 \cdot 9^{x-1} = 3\sqrt{2^{2x+1}}$, then $x =$ _____.

17. If $a > 0$, then $\sqrt{a + \sqrt{a + \sqrt{a + \cdots \infty}}}$ is

(a) $\frac{1}{2}\sqrt{(4a-1)}$ (b) $\frac{1}{2}[1 + \sqrt{(4a+1)}]$ (c) $\frac{1}{2}[1 - \sqrt{(4a-1)}]$ (d) $\frac{1}{2}[1 \pm \sqrt{(4a+1)}]$

18. $\sqrt{2} / \left\{\sqrt{2+\sqrt{3}} - \sqrt{2-\sqrt{3}}\right\} =$ _____

19. $\frac{3\sqrt{2}}{\sqrt{6}+\sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{6}+\sqrt{2}} + \frac{\sqrt{6}}{\sqrt{3}+\sqrt{2}} =$

(a) $5\sqrt{2}$ (b) $3\sqrt{2}$ (c) $2\sqrt{3}$ (d) 0

20. The value of $\sqrt{[12 - \sqrt{(68 + 48\sqrt{2})}]} =$

(a) $2 + \sqrt{2}$ (b) $2 - \sqrt{2}$ (c) $\sqrt{2} - 1$ (d) None of these

21. If $x + \sqrt{(x^2+1)} = a$, then x is

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(a) $\frac{1}{2}(a+1/a)$ (b) $\frac{1}{2}(a-1/a)$ (c) $(a+1/a)$ (d) None of these

22. If $x=\sqrt{7}+\sqrt{3}$ and $xy=4$, then $x^4+y^4=$_____

23. If $x=2+\sqrt{3}, xy=1,$ then $\left\{x/\left(\sqrt{2}+\sqrt{x}\right)\right\}+\left\{y/\left(\sqrt{2}-\sqrt{y}\right)\right\}=$

(a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) $\sqrt{5}$

24. If $x=3-\sqrt{5},$ then $\sqrt{x}/\left(\sqrt{2}+\sqrt{(3x-2)}\right)=$

(a) 5 (b) $\sqrt{5}$ (c) $1/5$ (d) $1/\sqrt{5}$

25. Solution of the equation $\sqrt{(x+10)}+\sqrt{(x-2)}=6$ are

(a) 0 (b) 6 (c) 4 (d) None of these

26. The expression $\left[(\sqrt{2})^{\sqrt{2}}\right]^{\sqrt{2}}$ gives

(a) a natural number (b) an integer and not a natural number
(c) a rational number but not an integer (d) a real number but not a rational number

27. If $16\times 8^{n+2}=2^m$, then m is equal to

(a) $n+8$ (b) $2n+10$ (c) $3n+2$ (d) $3n+10$

28. If $\sqrt{10+\sqrt[3]{x}}=4$, then the values of x is _____.

29. If $a=2+\sqrt{3}$, then what is the value a^2+a^{-2} is _____.

30. If $a^x=b$, $b^y=c$ and $xyz=1$, then what is the value of c^z?

(a) a (b) b (c) ab (d) a/b

31. If $3^{x+y}=81$ and $81^{x-y}=3$, then what is the value of x?

(a) $17/16$ (b) $17/8$ (c) $17/4$ (d) $15/4$

32. The value of $\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}+\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}=$_____.

33. If $2^m+2^{1+m}=24$, then the value of m is _____.

34. If $3^x\times 27^x=9^{x+4}$, then the value of x is _____.

35. If $p^x=r^y=m$ and $r^w=p^z=n$, then which one of the following is correct?

(a) $xw=yz$ (b) $xz=yw$ (c) $x+y=w+z$ (d) $x-y=w-z$

36. If $a^x=b^y=c^z$ and $abc=1$, then value of $xy+yz+zx$ is _____.

37. Out of a group of swans 3.5 times the square root of the number are swimming in the pool while the two remaining are playing outside the pool. What is the total number of swans? _____.

38. If $3.7^x=0.037^y=10000$, then the value of $(1/x)-(1/y)$ is _____.

39. If $a^x=c^q=b$ and $c^y=a^z=d$, then which one of the following is correct?

(a) $x/y=q/z$ (b) $x+y=q+z$ (c) $xy=qz$ (d) $x^y=q^z$

40. A ball is dropped from a height of 64 m above the ground and every time it hits the ground it rises to a height equal to half of the previous. What is the height attained after it hits the ground for the 16th time?

(a) 2^{-8} m (b) 2^{-9} (c) 2^{-10} (d) 2^{-11}

41. The value of $\frac{1}{1+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\cdots+\frac{1}{\sqrt{15}+\sqrt{16}}$ is _____.

42. If $(ab^{-1})^{2x-1}=(ba^{-1})^{x-2}$, then the value of x is _____.

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43. If $x^{1/m} = y^{1/n} = z^{1/p}$ and $xyz = 1$, then the value of $m + n + p$ is _____.

44. The sum of the square of a number and the square of the reciprocal of the number is thrice the difference of the square of the number and the square of the reciprocal of the number. What is the number?

(a) 1 (b) 2 (c) $\sqrt{2}$ (d) $\sqrt{\sqrt{2}}$

45. Which of the following numbers is an integer?

(a) $\left\{\left(\sqrt{2}+\sqrt{3}\right)/\left(\sqrt{3}-\sqrt{2}\right)\right\}+\sqrt{6}$ (b) $\left\{\left(\sqrt{2}+\sqrt{3}\right)/\left(\sqrt{3}-\sqrt{2}\right)\right\}+2\sqrt{6}$

(c) $\left\{\left(\sqrt{2}+\sqrt{3}\right)/\left(\sqrt{2}-\sqrt{3}\right)\right\}+2\sqrt{6}$ (d) $\left\{\left(\sqrt{2}+\sqrt{3}\right)/\left(\sqrt{2}-\sqrt{3}\right)\right\}+\sqrt{6}$

9.4 Logarithms

The theory of logarithms was already covered in section 2.2 of Engineering Mathematics. Let us consider some example:

Example [GA-2011 (1 mark)]: If $\log(P) = (1/2)\log(Q) = (1/3)\log(R)$, then which of the following options is TRUE?

(a) $P^2 = Q^3R^2$ (b) $Q^2 = PR$ (c) $Q^2 = R^3P$ (d) $R = P^2Q^2$

Solution (b): $\log(P) = \log(Q^{1/2}) = \log(R^{1/3}) \Rightarrow P = Q^{1/2} = R^{1/3} \Rightarrow P^2 = Q \Rightarrow P^4 = Q^2$ … (i) and $P^3 = R$ …(ii). (i)/(ii) $\Rightarrow PR = Q^2$.

Example [GA-2012 (2 marks)]: A value of x that satisfies the equation $\log x + \log(x-7) = \log(x+11) + \log 2$ is

(a) 1 (b) 2 (c) 7 (d) 11

Solution (c): For satisfying the properties of logarithms we must have $x > 0$, $x - 7 > 0$, $x + 11 > 0$; from these three inequalities we have $x \in (7, \infty)$. Now $\log x + \log(x-7) = \log(x+11) + \log 2 \Rightarrow \log\{x(x-7)\} = \log\{2(x+11)\} \Rightarrow x(x-7) = 2(x+11)$

$\Rightarrow x^2 - 7x = 2x + 22 \Rightarrow x^2 - 9x - 22 = 0 \Rightarrow x^2 - 11x + 2x - 22 = 0 \Rightarrow (x+2)(x-11) = 0 \Rightarrow x = -2, 11$.

As $-2 \notin (7, \infty)$ so our value of x is 11, as $11 \in (7, \infty)$.

Example [GA-2015 (1 mark)]: If $\log_x(5/7) = -1/3$, then the value of x is

(a) $343/125$ (b) $125/343$ (c) $-25/49$ (d) $-49/25$

Solution (a): $\log_x(5/7) = -1/3 \Rightarrow \{\log_e(5/7)\}/\{\log_e x\} = -(1/3) \Rightarrow \log_e x = -3\log_e(5/7) = 1.0094$

$\Rightarrow x = e^{1.0094} = 343/125$.

Example [GA-2015 (2 marks)]: $\log\tan 1^o + \log\tan 2^o + \cdots + \log\tan 89^o$ is

(a) 1 (b) $1/\sqrt{2}$ (c) 0 (d) -1

Solution (c): As $\log\tan 89^o = \log\tan(90^o - 1^o) = \log\cot 1^o = \log(1/\tan 1^o) = -\log\tan 1^o$; similarly $\log\tan 88^o = -\log\tan 2^o$; $\log\tan 87^o = -\log\tan 3^o$ and so on. So in the given expression equidistant terms cancel out each other and we left with $\log\tan 45^o = \log 1 = 0$.

Example [GA-2016 (2 marks)]: In a process, the number of cycles to failure decreases exponentially with an increase in load. At a load of 80 units, it takes 100 cycles for failure. When the load is halved, it takes 10000 cycles for failure. The load for which the failure will happen in 5000 cycles is _____.

(a) 40.00 (b) 46.02 (c) 60.01 (d) 92.02

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Solution (b): Let 'x' be the number of cycles to failure; and 'y' be the increase in load. As the number of cycles to failure decreases exponentially with an increase in load, so one of the possible relation between x and y can be given as: $y(\log x) = k$ …(i), where k is any constant. Now

At a load of 80 units, it takes 100 cycles for failure, so $80(\log 100) = k \Rightarrow 80 \times 2 = k \Rightarrow k = 160$ …(ii)

When the load is halved, it takes 10000 cycles for failure, so $(80/2)\{\log 10000\} = k$ $\Rightarrow 40\log(10000) = k \Rightarrow 40 \times 4 = k \Rightarrow k = 160$ …(iii).

Thus from (ii) and (iii), we can conclude that relation (i) is correct.

Hence for $x = 5000$, from (i), we have: $y(\log 5000) = 160 \Rightarrow y = 43.225$ which is closest to option (b). Thus option (b) is correct.

Exercise 9.2

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. $\log ab - \log|b| =$

(a) $\log a$ (b) $\log|a|$ (c) $-\log a$ None of these

2. The value of $\log_3 4 \log_4 5 \log_5 6 \log_6 7 \log_7 8 \log_8 9$ is _____.

3. $\log_7 \log_7 \sqrt{7(\sqrt{7\sqrt{7}})} =$

(a) $3\log_2 7$ (b) $1 - 3\log_3 7$ (c) $1 - 3\log_7 2$ (d) None of these

4. The value of $81^{1/\log_5 3} + 27^{\log_9 36} + 3^{4/\log_7 9}$ is _____.

5. If $\log_4 5 = a$ and $\log_5 6 = b$, then $\log_3 2$ is equal to

(a) $1/(2a+1)$ (b) $1/(2b+1)$ (c) $2ab+1$ (d) $1/(2ab-1)$

6. If $\log_5 a \cdot \log_a x = 2$, then x is equal to _____.

7. If $a^2 + 4b^2 = 12ab$, then $\log(a+2b)$ is

(a) $(1/2)[\log a + \log b - \log 2]$ (b) $\log(a/2) + \log(b/2) + \log 2$

(c) $(1/2)[\log a + \log b + 4\log 2]$ (d) $(1/2)[\log a - \log b + 4\log 2]$

8. If $A = \log_2 \log_2 \log_4 256 + 2\log_{\sqrt{2}} 2$, then A is equal to _____.

9. If $\log_{10} x = y$, then $\log_{1000} x^2$ is equal to

(a) y^2 (b) $2y$ (c) $3y/2$ (d) $2y/3$

10. If $x = \log_a(bc), y = \log_b(ca), z = \log_c(ab)$, then $(1+x)^{-1} + (1+y)^{-1} + (1+z)^{-1}$ is equal to ___.

11. If $a = \log_{24} 12, b = \log_{36} 24$ and $c = \log_{48} 36$, then $1 + abc$ is equal to

(a) $2ab$ (b) $2ac$ (c) $2bc$ (d) 0

12. If $a^x = b, b^y = c, c^z = a$, then value of xyz is _____.

13. If $\log x : \log y : \log z = (y-z):(z-x):(x-y)$ then

(a) $x^y \cdot y^z \cdot z^x = 1$ (b) $x^x y^y z^z = 1$ (c) $\sqrt[x]{x}\sqrt[y]{y}\sqrt[z]{z} = 1$ (d) None of these

14. $\log_4 2 - \log_8 2 + \log_{16} 2 - \cdots \infty$ is

(a) e^2 (b) $\ln 2 + 1$ (c) $\ln 2 - 1$ (d) $1 - \ln 2$

15. $\sum_{n=1}^{n} \left\{1/\left(\log_{2^n}(a)\right)\right\} =$

(a) $\frac{n(n+1)}{2}\log_a 2$ (b) $\frac{n(n+1)}{2}\log_2 a$ (c) $\frac{(n+1)^2 n^2}{4}\log_2 a$ (d) None of these

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16. Which of the following is not true?

(a) $\log(1+x) < x$ for $x > 0$ (b) $\{x/(1+x)\} < \log(1+x)$ for $x > 0$

(c) $e^x > 1+x$ for $x > 0$ (d) $e^x < 1-x$ for $x > 0$

17. The solution of the equation $\log_7 \log_5(\sqrt{x^2+5}+x) = 0$

(a) $x = 2$ (b) $x = 3$ (c) $x = 4$ (d) $x = -2$

18. $\log_4 18$ is

(a) a rational number (b) an irrational number

(c) a prime number (d) none of these

19. The value of $(0.05)^{\log_{\sqrt{20}}(0.1+0.01+0.001+\cdots)}$ is _____

20. If a, b, c are distinct positive numbers, such that $[\log_b a \log_c a - \log_a a] + [\log_a b \log_c b - \log_b b] + [\log_a c \log_b c - \log_c c] = 0$, then $abc =$ _____.

21. If $(\log x)/(b-c) = (\log y)/(c-a) = (\log z)/(a-b)$, then which of the following is true

(a) $xyz = 1$ (b) $x^a y^b z^c = 1$ (c) $x^{b+c} y^{c+a} z^{a+b} = 1$ (d) All are true

22. The number of real values of the parameter k for which $(\log_{16} x)^2 - \log_{16} x + \log_{16} k = 0$ with real coefficients will have exactly one solution is _____.

23. If $x^{(3/4)(\log_3 x)^2 + \log_3 x - (5/4)} = \sqrt{3}$ then x has

(a) One positive integral value (b) One irrational value

(c) Two positive rational values (d) All (a), (b), (c) are true

24. If $x = \log_5(1000)$ and $y = \log_7(2058)$ then

(a) $x > y$ (b) $x < y$ (c) $x = y$ (d) None of these

25. The set of real values of x satisfying $\log_{1/2}(x^2 - 6x + 12) \geq -2$ is

(a) $(-\infty, 2]$ (b) $[2, 4]$ (c) $[4, +\infty)$ (d) None of these

26. The set of real values of x for which $2^{\log_{\sqrt{2}}(x-1)} > x + 5$ is

(a) $(4, +\infty)$ (b) $(-\infty, -1) \cup (4, +\infty)$ (c) $(-1, 4)$ (d) None of these

27. Solution set of inequality $\log_{10}(x^2 - 2x - 2) \leq 0$ is

(a) $[-1, 1-\sqrt{3}]$ (b) $[1+\sqrt{3}, 3]$ (c) $[-1, 1-\sqrt{3}) \cup (1+\sqrt{3}, 3]$ (d) None of these

28. If $(1/2) \leq \log_{0.1} x \leq 2$ then

(a) the maximum value of x is $1/\sqrt{10}$ (b) x lies between $1/100$ and $1/\sqrt{10}$

(c) the minimum value of x is $1/100$ (d) All (a), (b) and (c) are true

29. If $\log_{0.04}(x-1) \geq \log_{0.2}(x-1)$ then x belongs to the interval

(a) $(1, 2]$ (b) $(-\infty, 2]$ (c) $[2, \infty)$ (d) None of these

30. The set of real values of x for which $\log_{0.2}\{(x+2)/x\} \leq 1$ is

(a) $(-\infty, -2.5] \cup (0, +\infty)$ (b) $[2.5, +\infty)$ (c) $(-\infty, -2) \cup (0, +\infty)$ (d) None of these

31. A real root of the equation $\log_4\{\log_2(\sqrt{x+8} - \sqrt{x})\} = 0$ is

(a) 1 (b) 2 (c) 3 (d) 4

32. The roots of the equation $7^{\log_7(x^2-4x+5)} = x - 1$ are

(a) 4, 5 (b) 2, –3 (c) 2, 3 (d) 3, 5

33. The solution set of the equation $(\log_x 2) \cdot (\log_{2x} 2) = \log_{4x} 2$ is

(a) $\{2^{-\sqrt{2}}, 2^{\sqrt{2}}\}$ (b) $\{0.5, 2\}$ (c) $\{0.25, 2^2\}$ (d) None of these

34. The solution of the equation $3^{\log_a x} + 3x^{\log_a 3} = 2$ is given by

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	(a) $3^{\log_2 a}$	(b) $3^{-\log_2 a}$	(c) $2^{\log_3 a}$	(d) $2^{-\log_3 a}$
35.	If $3^{x+1} = 6^{\log_2 3}$, then x is			
	(a) 3	(b) 2	(c) $\log_3 2$	(d) $\log_2 3$
36.	If $2\log(x+1) - \log(x^2-1) = \log 2$, then x equals			
	(a) 1	(b) 2	(c) 3	(d) 0
37.	The number of roots of the equation $\log(-2x) = 2\log(x+1)$ are _____.			
38.	The number of real solutions of the equation $\log_{0.5} x = \lvert x \rvert$ is _____.			
39.	If product of roots of the equation $x^2 - 3kx + 2e^{2\log k} - 1 = 0$ is 7, then its roots will real when			
	(a) $k = 1$	(b) $k = 2$	(c) $k = 3$	(d) None of these
40.	The value of x satisfying $\log_a x + \log_{\sqrt{a}} x + \log_{\sqrt[3]{a}} x + \cdots + \log_{\sqrt[n]{a}} x = (a+1)/2$ will be			
	(a) $x = a$	(b) $x = a^a$	(c) $x = a^{-1/a}$	(d) $x = a^{1/a}$
41.	If $\log_3 2$, $\log_3(2^x - 5)$ and $\log_3\left(2^x - (7/2)\right)$ are in A.P., then x is equal to			
	(a) $1, 1/2$	(b) $1, 1/3$	(c) $1, 3/2$	(d) None of these
42.	If 1, $\log_y x$, $\log_z y$, $-15\log_x z$ are in A.P., then			
	(a) $z^3 = x$	(b) $x = y^{-1}$	(c) $z^{-3} = y$	(d) All (a), (b) and (c) are true
43.	The first and last terms of a G.P. are a and l respectively, r being its common ratio; then the number of term in this G.P. is			
	(a) $\dfrac{\log l - \log a}{\log r}$	(b) $1 - \dfrac{\log l - \log a}{\log r}$	(c) $\dfrac{\log a - \log l}{\log r}$	(d) $1 + \dfrac{\log l - \log a}{\log r}$
44.	If $\log_x a, a^{x/2}$ and $\log_b x$ are in G.P., then $x =$			
	(a) $-\log_a(\log_b a)$		(b) $-\log_a(\log_a b)$	
	(c) $\log_a(\log_e a) - \log_a(\log_e b)$		(d) $\log_a(\log_e b) - \log_a(\log_e a)$	
45.	$\log_3 2, \log_6 2, \log_{12} 2$ are in			
	(a) AP	(b) GP	(c) HP	(d) None of these

9.5 Functions

The theory on function is already covered in chapter 2 of Engineering Mathematics section. Let us consider some examples:

Example [GA-2010 (2 marks)]: Given the following four functions $f_1(n) = n^{100}$, $f_2(n) = 1.2^n$, $f_3(n) = 2^{n/2}$, $f_4(n) = 3^{n/3}$, which function will have the largest value for sufficiently large values of n (i.e. $n \to \infty$)?

(a) f_4 (b) f_3 (c) f_2 (d) f_1

Solution (a): $f_3(n) = 2^{n/2} = (2^{1/2})^n = 1.414^n$; $f_4(n) = 3^{n/3} = (3^{1/3})^n = 1.442^n$. As $1.2 < 1.414 < 1.442 \Rightarrow$ when $n \to \infty$, we have $1.2^n < 1.414^n < 1.442^n \Rightarrow f_2 < f_3 < f_4$. As $\log f_1 = 100\log n$ and $\log f_2 = n\log 1.2 = 0.08n$. Now, let $L = \lim_{n\to\infty} \dfrac{\log f_1}{\log f_2} = \lim_{n\to\infty} \dfrac{100\log n}{0.08n}$ $\Rightarrow L = 1250 \lim_{n\to\infty} \dfrac{\log n}{n} = 1250 \lim_{n\to\infty} \dfrac{1}{n}$ (by L'Hospital rule). So $\Rightarrow L = 1250 \lim_{n\to\infty} \dfrac{1}{n} \to 0$. Now as $n \to \infty$, $L = \dfrac{\log f_1}{\log f_2} \to 0 \Rightarrow \log f_1 \ll \log f_2 \Rightarrow f_1 \ll f_2$. Thus we have $f_1 \ll f_2 < f_3 < f_4$. Hence f_4 will have the largest value for sufficiently large values of n (i.e. $n \to \infty$).

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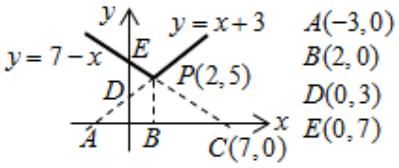
Example [GA-2010 (1 mark)]: Consider the function $f(x)=\max(7-x,x+3)$. In which range does f take its minimum value?

(a) $-6\le x<-2$ (b) $-2\le x<2$ (c) $2\le x<6$ (d) $6\le x<10$

Solution (c): $f(x)=\max(7-x,x+3)$ is shown in the figure with dark line. Point $P(2,5)$ is the intersection of $y=x+3$ and $y=7-5$. From the figure it is clear that $f(x)$ attains a minimum value of 5 at $x=2$ which lies in the range of x given in option (c). So option (c) is correct.



Example [GA-2011 (2 marks)]: The variable cost (V) of manufacturing a product varies according to the equation $V=4q$, where q is the quantity produced. The fixed cost (F) of production of same product reduces with q according to the equation $F=100/q$. How many units should be produced to minimize the total cost $(V+F)$?

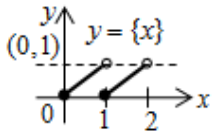
(a) 5 (b) 4 (c) 7 (d) 6

Solution (a): Let $C=V+F=4q+100/q$; for minimizing the cost we must have $dC/dq=0$ and $d^2C/dq^2>0$. So $dC/dq=(dV/dq)+(dF/dq)=4-(100/q^2)=0\Rightarrow q=\pm5$; $d^2C/dq^2=200/q^3>0$ for $q=5$. Thus 5 units should be produced to minimize the total cost $(V+F)$.

Example [GA-2012 (2 marks)]: $f(x)=x-[x]$, where $x\ge0$ and $[x]$ is the greatest integer not larger than x then $f(x)$ is a

(a) monotonically increasing function
(b) monotonically decreasing function
(c) linearly increasing function between two integers
(d) linearly decreasing function between two integers

Solution (c): $f(x)=x-[x]=\{x\}$ whose graph is given in the figure. Clearly it is a linearly increasing function between two integers. So option (c) is correct.



Example [GA-2012 (1 mark)]: The cost function for a product in a firm is given by $5q^2$, where q is the amount of production. The firm can sell the product at a market price of ₹50 per unit. The number of units to be produced by the firm such that the profit is maximized is

(a) 5 (b) 10 (c) 15 (d) 25

Solution (a): Let P be the profit; so $P=$ selling price – production price $=50q-5q^2$; for maximizing the profit (P) we must have $dP/dq=0$ and $d^2P/dq^2<0$. So $dP/dq=50-10q=0\Rightarrow q=5$; $d^2P/dq^2=-10<0$ for $q=5$. Thus 5 units should be produced to maximize the profit.

Example [GA-2012 (2 marks)]: A political party orders an arch for the entrance to the ground in which the annual convention is being held. The profile of the arch follows the equation $y=2x-0.1x^2$ where y is the height of the arch in meters. The maximum possible height of the arch is

(a) 8 meters (b) 10 meters (c) 12 meters (d) 14 meters

Solution (b): The maximum value of the given function is found when $dy/dx=0\Rightarrow2-0.2x=0\Rightarrow x=10$ and $d^2y/dx^2<0\Rightarrow-0.2<0$ for $x=10$. Thus $x=10$ is the point of maxima and so the maximum value of the given function is $y=2\times10-0.1(10)^2=10$.

Example [GA-2014 (1 mark)]: If $(z+1/z)^2=98$, compute (z^2+1/z^2). _____

Solution: $(z+1/z)^2=98\Rightarrow z^2+1/z^2+2=98\Rightarrow z^2+1/z^2=96$.

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Example [GA-2014 (1 mark)]: Let $f(x,y)=x^n y^m=P$. If x is doubled and y is halved, the new value of f is

(a) $2^{n-m}P$ (b) $2^{m-n}P$ (c) $2(n-m)P$ (d) $2(m-n)P$

Solution (a): If x is doubled and y is halved, then $f(2x,y/2)=(2x)^n(y/2)^m=2^n x^n(1/2^m)y^m=2^{n-m}x^n y^m=2^{n-m}P$.

Example [GA-2014 (1 mark)]: The value of $\sqrt{12+\sqrt{12+\sqrt{12+\cdots}}}$ is

(a) 3.464 (b) 3.932 (c) 4.000 (d) 4.444

Solution (c): $y=\sqrt{12+\sqrt{12+\sqrt{12+\cdots}}}\Rightarrow y=\sqrt{12+y}\Rightarrow y^2=12+y\Rightarrow y^2-y-12=0\Rightarrow y=4,-3$

Example [GA-2014 (1 mark)]: If $y=5x^2+3$, then the tangent at $x=0$, $y=3$

(a) passes through $x=0$, $y=0$ (b) has a slope of $+1$

(c) is parallel to the $x-$axis (d) has a slope of -1

Solution (c): Slope of tangent at $x=0$, $y=3$ is $m=(dy/dx)_{(x,y)}=(10x)_{(0,3)}=0$. Since slope is zero so the tangent at $x=0$, $y=3$ on the curve $y=5x^2+3$ is parallel to the $x-$axis.

Example [GA-2015 (2 marks)]: If $a^2+b^2+c^2=1$, then $ab+bc+ac$ lies in the interval

(a) $[1,2/3]$ (b) $[-1/2,1]$ (c) $[-1,1/2]$ (d) $[2,-4]$

Solution (b): Given $a^2+b^2+c^2=1$; we know that $(a+b+c)^2\geq 0$ $\Rightarrow a^2+b^2+c^2+2(ab+bc+ca)\geq 0\Rightarrow (ab+bc+ca)\geq -1/2$ …(i). We also know that $(a-b)^2+(b-c)^2+(c-a)^2\geq 0\Rightarrow 2(a^2+b^2+c^2)-2(ab+bc+ca)\geq 0\Rightarrow 2-2(ab+bc+ca)\geq 0$ $\Rightarrow (ab+bc+ca)\leq 1$ …(ii). Thus from (i) and (ii), we have $-1/2\leq (ab+bc+ca)\leq 1$.

Example [GA-2015 (2 marks)]: If $x>y>1$, which of the following must be true?

(i) $\ln x>\ln y$; (ii) $e^x>e^y$; (iii) $y^x>x^y$; (iv) $\cos x>\cos y$.

(a) (i) and (ii) (b) (i) and (iii) (c) (iii) and (iv) (d) (ii) and (iv)

Solution (a): $\ln a=\log_e a$ and $e=2.718>1$ so we get greater the value if greater will be its log and greater the value greater the power of e. So statements (i) and (ii) are correct. For statement (iii), let us consider an example, let $x=3$ and $y=2$ then $x^y=3^2=9$ and $y^x=2^3=8$, so here $x^y>y^x$. For statement (iii), if $x>y$ then for all values of x and y we cannot have always $\cos x>\cos y$.

Example [GA-2015 (2 marks)]: If p,q,r,s are distinct integers such that:

(i) $f(p,q,r,s)=\max(p,q,r,s)$ (ii) $g(p,q,r,s)=\min(p,q,r,s)$

(iii) $h(p,q,r,s)=$ remainder of $(p\times q)/(r\times s)$ if $(p\times q)>(r\times s)$ or $h(p,q,r,s)=$ remainder of $(r\times s)/(p\times q)$ if $(r\times s)>(p\times q)$

Also a function $fgh(p,q,r,s)=f(p,q,r,s)\times g(p,q,r,s)\times h(p,q,r,s)$. Also the same operation are valid with two variable functions of the form $f(p,q)$. What is the value of $fg\{h(2,5,7,3),4,6,8\}$? _____.

Solution: As $7\times 3>2\times 5$ so $h(2,5,7,3)=$ rem of $(7\times 3)/(2\times 5)=$ rem of $21/10=1$. Now $fg\{h(2,5,7,3),4,6,8\}=fg\{1,4,6,8\}=f(1,4,6,8)\times g(1,4,6,8)$

$\Rightarrow fg\{h(2,5,7,3),4,6,8\}=\max(1,4,6,8)\times\min(1,4,6,8)=8\times 1=8$.

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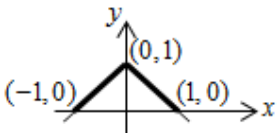
Example [GA-2015 (2 marks)]: Consider a function $f(x)=1-|x|$ on $-1\le x\le 1$. The value of x at which the function attains a maximum, and the maximum value of the function are:

(a) $0,-1$ (b) $-1,0$ (c) $0,1$ (d) $-1,2$

Solution (c): From the graph of $y=f(x)=1-|x|$ on $-1\le x\le 1$, shown in dark lines, we can say that the function $f(x)$ attains a maximum value of $y=1$ at $x=0$ and minimum value of $y=0$ at $x=\pm 1$.



Example [GA-2015 (1 mark)]: A function $f(x)$ is linear and has value of 29 at $x=-2$ and 39 at $x=3$. Find its value at $x=5$.

(a) 59 (b) 45 (c) 43 (d) 35

Solution (c): As $f(x)$ is a linear function in x; so let $f(x)=ax+b$. $\because f(-2)=29\Rightarrow 29=-2a+b$ …(i); and $\because f(3)=39\Rightarrow 39=3a+b$ …(ii). Solving (i) and (ii) we get $a=2$ and $b=33$. So $f(x)=2x+33$ and thus $f(5)=2\times 5+33=43$.

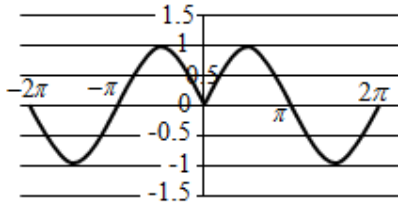
Example [GA-2015 (1 mark)]: Operators $\square$, $\Diamond$ and $\rightarrow$ are defined as:
$a\square b=(a-b)/(a+b)$; $a\Diamond b=(a+b)/(a-b)$; $a\rightarrow b=ab$. Find the value of $(66\square 6)\rightarrow(66\Diamond 6)$.

(a) -2 (b) -1 (c) 1 (d) 2

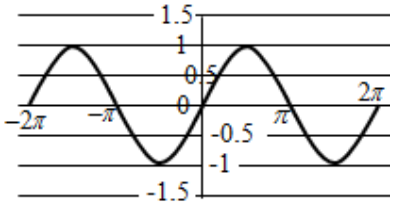
Solution (c): $(66\square 6)\rightarrow(66\Diamond 6)=\left(\frac{66-6}{66+6}\right)\rightarrow\left(\frac{66+6}{66-6}\right)=\frac{60}{72}\rightarrow\frac{72}{60}=\frac{60}{72}\times\frac{72}{60}=1$

Example [GA-2016 (2 marks)]: Which of the following curves represents the function $y=\ln\left(\left|e^{\left[|\sin(|x|)|\right]}\right|\right)$ for $|x|<2\pi$? Here, x represents the abscissa and y represents the ordinate.

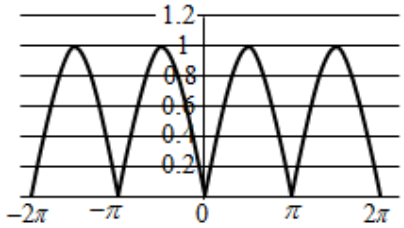
(a)



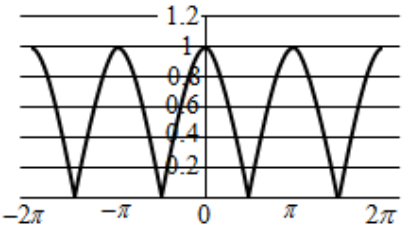
(b)



(c)

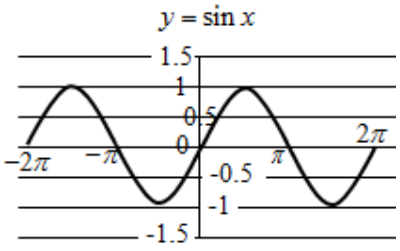


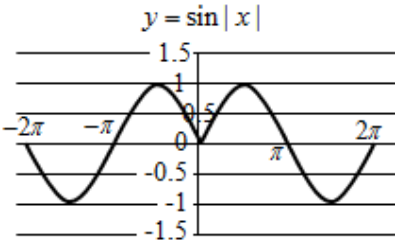
(d)

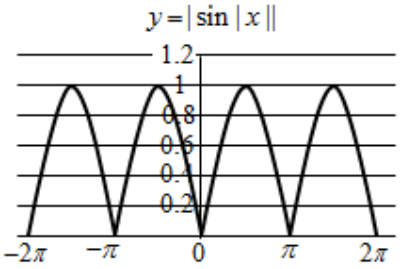


Solution (c): The given function $y=\ln\left(\left|e^{\left[|\sin(|x|)|\right]}\right|\right)=\left|\sin\left(|x|\right)\right|$, so for plotting the graph of $y=\left|\sin\left(|x|\right)\right|$: first we plot $y=\sin x$ for $x\in(-2\pi,2\pi)$, as shown in figure (*a*); then $y=\sin|x|$ for $x\in(-2\pi,2\pi)$, as shown in figure (*b*); and then $y=\left|\sin\left(|x|\right)\right|$ for $x\in(-2\pi,2\pi)$, as shown in figure (*c*).

(*a*)



(b) 

(c) 

Example [GA-2016 (2 marks)]: A wire of length 340 mm is to be cut into two parts. One of the parts is to be made into a square and the other into a rectangle where sides are in the ratio of 1:2. What is the length of the side of the square (in mm) such that the combined area of the square and the rectangle is a **MINIMUM?**

(a) 30 (b) 40 (c) 120 (d) 180

Solution (b): Let the length and width of rectangle is x and $2x$, respectively. So perimeter of rectangle is $= 2(x+2x) = 6x$;

Thus perimeter of square $= 340 - 6x$ and so the side of square $= (340-6x)/4$.

Now the combined area is area of square + area of rectangle $= A = \{(340-6x)/4\}^2 + x \times 2x$

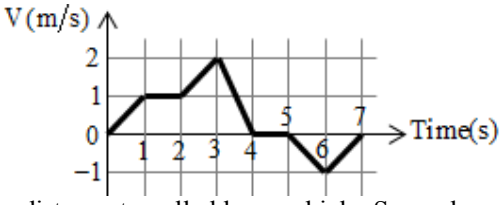
$\Rightarrow A = \{(340-6x)/4\}^2 + 2x^2$.

For critical points of A, we have $\Rightarrow \dfrac{dA}{dx} = 0 \Rightarrow 2\left(\dfrac{340-6x}{4}\right)\left(\dfrac{-6}{4}\right) + 4x = 0 \Rightarrow x = 30$ mm

$\Rightarrow \dfrac{d^2A}{dx^2} = 0 \Rightarrow (-3)(-6) + 4 = 18 \Rightarrow \left.\dfrac{d^2A}{dx^2}\right|_{x=204} > 0$, so at $x = 30$ mm, the value of A is minimum.

So side of square is $= \{340 - 6(30)\}/4 = 40$ mm

Example [GA-2016 (2 marks)]: The velocity V of a vehicle along a straight line is measured in m/s and plotted as shown with respect to time in seconds. At the end of the 7 seconds, how much will the odometer reading increase by (in m)?

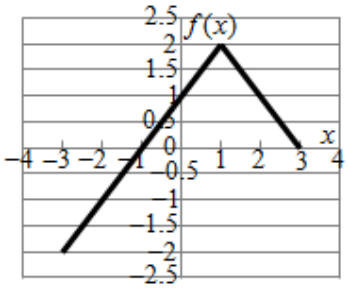


(a) 0 (b) 3 (c) 4 (d) 5

Solution (d): An odometer is an instrument that indicates distance travelled by a vehicle. So we have to find the area of velocity-time graph which gives the distance travelled. So area of given V-T graph is $\dfrac{1}{2}(1-0)(1-0) + (2-1)(1-0) + \dfrac{1}{2}(1+2)(3-2) + \dfrac{1}{2}(4-3)(2-0) + (5-4)(0) + \dfrac{1}{2}(7-5)(1-0) = 5$.

Thus option (d) is correct.

Example [GA-2016 (2 marks)]: Choose the correct expression for $f(x)$ given in the graph.



(a) $f(x) = 1 - |x-1|$

(b) $f(x) = 1 + |x-1|$

(c) $f(x) = 2 - |x-1|$

(d) $f(x) = 2 + |x-1|$

Solution (c): At $x = 1$, we have $f(x) = 2$, which is given by options (c) and (d). Thus option (a) and (b) are not correct. Now again from the graph, at $x = 3$ we must have $f(x) = 0$, which is given by only option (c). So option (d) is not correct and thus option (c) is correct.

Example [GA-2016 (2 marks)]: Find the area bounded by the lines $3x + 2y = 14$, $2x - 3y = 5$ in the first quadrant.

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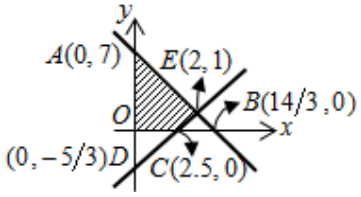
(a) 14.95 (b) 15.25 (c) 15.70 (d) 20.35

Solution (b): The point of intersection of the given lines is $E(2,1)$. So the required area will be the area of dotted region, which is equal to A = area of $\triangle OAB$ – area of $\triangle BEC$

$$\Rightarrow A = \frac{1}{2}\left(\frac{14}{3}-0\right)(7) - \frac{1}{2}\left(\frac{14}{3}-\frac{5}{2}\right)(1) = \frac{49}{3}-\frac{13}{12} = \frac{183}{12} = 15.25$$



Example [GA-2016 (1 mark)]: If $|9y-6| = 3$, then $y^2 - (4y/3)$ is _____.

(a) 0 (b) $+1/3$ (c) $-1/3$ (d) Undefined

Solution (c): $|9y-6| = 3 \Rightarrow 9y-6 = \pm 3 \Rightarrow 9y = 6 \pm 3 \Rightarrow y = 1$ or $1/3$.

At $y = 1$, $y^2 - (4y/3) = 1^2 - (4/3) = -1/3$

At $y = 1/3 \Rightarrow y^2 - (4y/3) = (1/3)^2 - (4/9) = -3/9 = -1/3$. So option (c) is correct.

Example [GA-2016 (2 marks)]: The binary operation □ is defined as $a \square b = ab + (a+b)$, where a and b are any two real numbers. The value of the identity element of this operation, defined as the number x such that $a \square x = a$, for any a, is _____.

(a) 0 (b) 1 (c) 2 (d) 10

Solution (a): Replacing 'b' by 'x', we get $a \square x = ax + (a+x) = a \Rightarrow a(x+1) + x = a$ which hold true if and only if $x = 0$ and $(x+1) = 1 \Rightarrow x = 0$ is the only solution. So option (a) is correct.

Example [GA-2016 (1 mark)]: Given $(9 \text{ inches})^{1/2} = (0.25 \text{ yards})^{1/2}$, which one of the following statements is **TRUE**?

(a) 3 inches = 0.5 yards (b) 9 inches = 1.5 yards
(c) 9 inches = 0.25 yards (d) 81 inches = 0.0625 yards

Solution (c): Squaring both sides of the given relation we get 9 inches = 0.25 yards. So option (c) is correct.

Example [GA-2016 (1 mark)]: The sum of the digits of a two digit number is 12. If the new number formed by reversing the digits is greater than the original number by 54, find the original number.

(a) 39 (b) 57 (c) 66 (d) 93

Solution (a): Let $xy = x \times 10 + y \times 1 = 10x + y$ be a two digit number.

So sum of the digits of a two digit number is 12 $\Rightarrow x + y = 12$ …(i).

The new number formed by reversing the digits of xy is $yx = y \times 10 + x \times 1 = 10y + x$, which is greater than the original number by 54, $\Rightarrow (10y + x) = (10x + y) + 54 \Rightarrow 9y = 9x + 54 \Rightarrow y = x + 6$ …(ii).

So from (i) and (ii), we get $x = 3$, $y = 9$. Hence option (a) is correct.

Please note that the exercise on function is already given in chapter 2 as it is a common topic on Engineering Mathematics and General Aptitude.

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Answer Keys

Answer Keys: Exercise 9.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
a	d	1	4	a	2	d	b	d	a	d	b	1	3	2
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
1.5	b	1	d	b	b	368	b	d	b	d	d	216	14	a
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
b	8	3	4	a	0	16	0.5	c	c	3	1	0	c	c

Answer Keys: Exercise 9.2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	2	c	890	d	25	c	5	d	1	c	1	b	d	a
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
d	c	b	81	1	d	1	d	a	b	a	c	d	c	a
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
a	c	a	d	d	c	2	1	b	d	d	d	b	c	c

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Chapter 10 : Mensuration, Geometry, Lines and Circles

10.1 Mensuration and Geometry

Basic Conversions

- 1 m = 100 cm = 1000 mm
- 1 quintal = 100 kg
- 1 kg = 2.2 pounds (approx.)
- 1 inch = 2.54 cm
- 10 quintal = 1 tonne = 1000 kg
- 1 litre = 1000 cubic cm

Straight Lines

- **Parallel lines:** Two straight are parallel if they lie on the same plane and do not intersect at any point.
- **Transversal lines:** A straight line called as transversal line if it intersects two parallel lines. The properties of transversal lines are:
  - Corresponding angles are equal, i.e. in Fig. 10.1, $\angle 1 = \angle 5$, $\angle 2 = \angle 6$, $\angle 3 = \angle 7$, $\angle 4 = \angle 8$.
  - Alternate interior angles are equal, i.e. in Fig. 10.1, angles in pairs $\angle 4 = \angle 6$, $\angle 5 = \angle 3$.
  - Alternate exterior angles are equal, i.e. in Fig. 10.1, $\angle 2 = \angle 8$, $\angle 1 = \angle 7$
  - The sum of interior angles on the same side of transversal line is 180^o, i.e. in Fig. 10.1, $\angle 4 + \angle 5 = \angle 3 + \angle 6 = 180^o$.

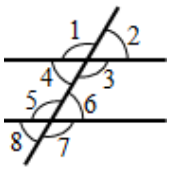

Figure 10.1: Angles in Transversal lines

Polygons: Polygons are plane figures formed by a closed series of straight line segments. Polygons are of two types: (i) **Regular polygons** (having all sides and all angles are equal); (ii) **Irregular polygons** (having all the sides and angles are not equal). Polygons can also be divided on the basis of number of sides and sum of interior angles which are given as:

No. of sides	Polygon Name	Sum of interior angles
3	Triangle	180^o
4	Quadrilateral	360^o
5	Pentagon	540^o
6	Hexagon	720^o
7	Heptagon	500^o
8	Octagon	1080^o

The basic properties of polygons are given as:

- Sum of interior angles of polygon with n sides is $(n-2)\pi$ radian $= (n-2)180^o$
- Sum of exterior angles of polygon with n sides is 360^o. It is to be noted that an exterior angle of a polygon is an angle that forms a linear pair with one of the angles of the polygon, i.e. two exterior angles can be formed at each vertex of a polygon; the exterior angle is formed by one side of the polygon and the extension of the adjacent side. As shown in Fig. 10.2, $\angle 1$, $\angle 2$ are exterior angles, but $\angle 3$ is not an exterior angle.

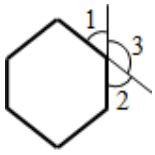

Figure 10.2: Exterior angle in a polygon

- Each exterior angle of a regular polygon is $360^o/n$, where n is the number of sides in a polygon.
- Area of a regular polygon with n sides is $A = (1/4)nl^2 \cot(180^o/n)$, l is the length of each side.
- Perimeter of a regular polygon with n sides is $A = nl$, where l is the length of each side.

Triangles: A triangle is a polygon having three sides and sum of all interior angles is 180^o. Two triangles are congruent if all the sides and angles of one are equal to the corresponding sides and angles of other. The notation for congruency is '$\cong$'. Two triangles are said to be similar if their corresponding angles are equal and corresponding sides have the same ratio. The notation for similar triangles is '$\sim$'. There are various types of triangles which are described as:

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- **Acute angle triangle:** It is a triangle having all the interior angles are less than 90^o.
- **Obtuse angle triangle:** It is a triangle having only one of the interior angle is more than 90^o.
- **Right angle triangle:** It is a triangle having one of the interior angle is equal to 90^o.
- **Equilateral triangle:** It is a triangle having all the interior angles is equal to 60^o.
- **Isosceles triangle:** It is a triangle having two of its sides is equal and consequently the interior angles opposite to the equal sides are also equal.
- **Scalene triangle:** It is a triangle with none of the sides equal to any other sides.

The following are the properties related to triangles:

- Sum of lengths of any two sides of a triangle is always greater than the third side.
- Difference between the lengths of any two sides of a triangle is always less than the third side.
- The side of a triangle which is opposite to the greatest angle will be greatest and the side opposite to the smallest angle will be the smallest.
- The sine rule: $a/(\sin A) = b/(\sin B) = c/(\sin C) = 2R$; and the cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$, where a, b, c are the sides of triangle and A, B, C are the angles opposite to the sides a, b, c, respectively.
- In case of a right angle triangle, with right angle at A, i.e. $\angle A = 90^o$, the cosine rule becomes $a^2 = b^2 + c^2$.
- The exterior angle is equal to the sum of two interior angles which are not adjacent to it, i.e. in Fig. 10.3, we have $\angle ACD = \angle BCE = \angle CAB + \angle ABC$.

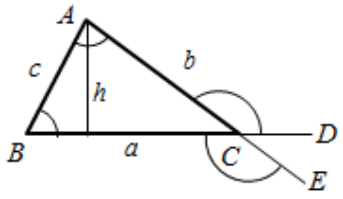

Figure 10.3: Angles in a triangle

- **Area of a triangle:** There are various methods for finding the area of a triangle. For the triangle shown in Fig. 10.3, the methods are given as:
  - Area of triangle $= (1/2)\text{Base} \times \text{Height}$, in Fig. 10.3, if we consider base as 'a', then height (which is the perpendicular distance between the base and vertex opposite to it) is 'h', then area of triangle is $A = ah/2$.
  - Area of triangle, $A = \sqrt{s(s-a)(s-b)(s-c)}$, where $s = (a+b+c)/2 =$ semi-perimeter of the triangle.
  - $A = \frac{1}{2} \times$ product of two sides $\times$ sine of the included angle $= \frac{1}{2}ab\sin C = \frac{1}{2}ac\sin B = \frac{1}{2}bc\sin A$
  - Area of triangle, $A = abc/4R$, where R is the circum-radius of the triangle.
- **Equilateral triangle:** In an equilateral triangle all three sides are equal and all three internal angles are also congruent to each other and are each 60^o.
  - The area of equilateral triangle having side of 'a' length is $\sqrt{3}a^2/4$.
  - The height 'h' of an equilateral triangle is $\sqrt{3}a/2$.
  - The circum-radius of an equilateral triangle is $2h/3 = a/\sqrt{3}$.
  - The in-radius of an equilateral triangle is $r = h/3 = a/(2\sqrt{3})$.
  - The in-centre and circum-centre lies at a point that divides the height in the ratio $2:1$.
  - The circum-radius is always twice the in-radius.
  - Among all the triangles that can be formed with a given perimeter, the equilateral triangle will have the maximum area.
  - An equilateral triangle in a circle will have the maximum area compared to other triangles inside the same circle.

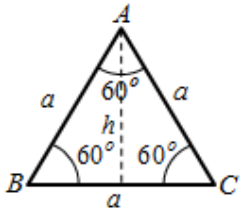

Figure 10.4: Equilateral Triangle

- **Isosceles triangle:** In isosceles triangle two of its sides are equal and consequently the interior angles opposite to the equal sides are also equal. If a is the length of two equal sides and b is the length of third side then area of isosceles triangle is $A = (b/4)\sqrt{4a^2 - b^2}$.

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- **Right angled triangle:** In right angled triangle, the side opposite to 90^o is hypotenuse. In Fig. 10.5, we have a right angled triangle with right angle at A, and BC is the hypotenuse side, for $\angle ABC = \theta$, AB is the base side and AC is the perpendicular side. So using Pythagoras theorem, we have $BC^2 = AB^2 + AC^2 \Rightarrow a^2 = b^2 + c^2$. The properties of right angled triangle are given as:

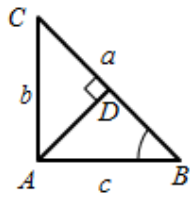

Figure 10.5: Right angled triangle

  - Area $= (1/2)AB \times AC = bc/2 = rs$, where $r = bc/(a+b+c) =$ in-radius and $s = (a+b+c)/2 =$ semi-perimeter of right angled triangle
  - Circum-radius of right angled triangle, $R = (1/2)$hypotenuse $= a/2$
  - AD is the perpendicular from A on BC; and $\Delta ABC \sim \Delta DBA \sim \Delta DAC$
  - $\Delta ABC \sim \Delta DBA \Rightarrow AB/BC = DB/BA \Rightarrow AB^2 = DB \times BC$
  - $\Delta ABC \sim \Delta DAC \Rightarrow AC/BC = DC/AC \Rightarrow AC^2 = DC \times BC$
  - $\Delta DBA \sim \Delta DAC \Rightarrow DA/DB = DC/DA \Rightarrow DA^2 = DB \times DC$

The following are the important terms related to the triangles:

- **Centroid of a triangle:** The centroid of a triangle is the point of intersection of its medians. The centroid divides the medians in the ratio $2:1$ (Vertex : base), i.e. if G be the centroid upon one of the median (say) AD, then $AG:GD = 2:1$

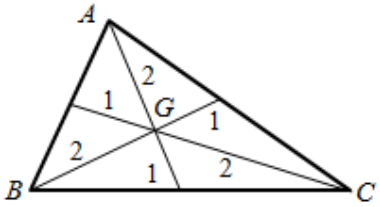

Figure 10.6: Centroid of a triangle

- **Circum-centre:** The circum-centre of a triangle is the point of intersection of the perpendicular bisectors of the sides of a triangle. It is the centre of the circle which passes through the vertices of the triangle and so its distance from the vertices of the triangle is the same and this distance is known as the circum-radius of the triangle. If a triangle is right angle, then its circum-centre is the mid-point of hypotenuse.
- **In-centre:** The in-centre of a triangle is the point of intersection of internal bisector of the angles. Also it is a centre of a circle touching all the sides of a triangle.
- **Ex-circle:** A circle touches one side outside the triangle and other two extended sides then circle is known as ex-circle.

<u>Quadrilaterals</u>: A quadrilateral is a four sided polygon with four angles. For any quadrilateral:

- Area $= (1/2)$(product of diagonal) $\times$ (sine of angle between them), i.e. in Fig. 10.7, area of quadrilateral, $A = (1/2)d_1 d_2 \sin\theta_1 = (1/2)d_1 d_2 \sin\theta_2$, where $d_1 = AC$, $d_2 = BD$, also $\theta_1 + \theta_2 = 180^o$.

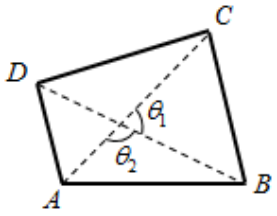

Figure 10.7: A quadrilateral

- Area $= (1/2)$(diagonal) $\times$ (sum of offsets), i.e. in Fig. 10.8, area of quadrilateral, $A = \frac{1}{2} \times d(a+b)$, where d is the length of diagonal and a, b as the offsets (or length perpendiculars from opposite vertices) corresponding to the diagonal d.

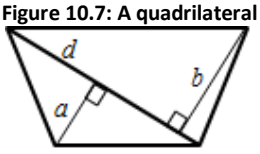

Figure 10.8: A quadrilateral

- The sum of all angles of a quadrilateral is 360^o.
- Area of circumscribed quadrilateral, $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$, where $s = \frac{s+b+c+d}{2}$, a, b, c, d are the lengths (taken in either clockwise or anticlockwise sense) of the sides of a quadrilateral.

There are various types of quadrilaterals which are described as:

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- **Parallelogram:** A parallelogram is a quadrilateral whose opposite sides are parallel and equal. As shown in Fig. 10.9, a parallelogram having base of length b, side of length a, and perpendicular distance between lengths b is h
  - Area of parallelogram, $A = b \times h = ab\sin\theta$
  - Perimeter of parallelogram, $P = 2(a+b)$
  - Diagonals of a parallelogram bisect each other
  - Bisectors of the angles of a parallelogram for a rectangle
  - A parallelogram inscribed in a circle is a rectangle
  - A parallelogram circumscribed about a circle is a rhombus
  - The opposite angles in a parallelogram are equal
  - The sum of squares of the diagonals is equal to the sum of squares of the four sides, i.e. $AC^2 + BD^2 = AB^2 + BC^2 + CD^2 + AD^2 = 2(AB^2 + BC^2)$.

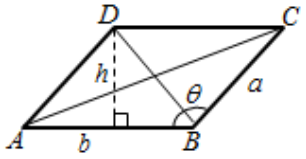

Figure 10.9: A Parallelogram

- **Rectangle:** A rectangle is a parallelogram with all interior angles 90°. As shown in Fig. 10.10, a rectangle of length l and breadth b
  - Area of rectangle, $A = l \times b$
  - Perimeter of rectangle, $P = 2(l+b)$
  - Diagonal $AC^2 = AB^2 + BC^2$
  - The two diagonals in a rectangle are equal and bisect each other

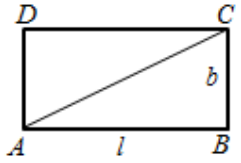

Figure 10.10: A Rectangle

- **Rhombus:** A rhombus is a parallelogram having all the sides equal. As shown in Fig. 10.11, a rhombus having a and b as its diagonals and l as the length of its sides. The diagonals of rhombus bisect each other at 90°.
  - Area of rhombus, $A = ab/2$; Perimeter of a rhombus, $P = 4l$
  - Area of rhombus, $A = l^2 \times \sin\theta$, where θ is the angles between adjacent sides.

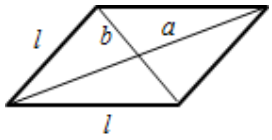

Figure 10.11: A Rhombus

- **Square:** A square is a rectangle with adjacent sides equal or a rhombus with each angle 90°. As shown in figure, a square of side a,
  - Area of square, $A = a^2$
  - Perimeter of square, $P = 4a$
  - In-radius, $r = a/2$; Circum-radius, $R = AC = a/\sqrt{2}$

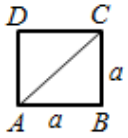

Figure 10.12: A square

- **Trapezium:** A trapezium is a quadrilateral with only two sides parallel to each other. As shown in Fig. 10.14, a trapezium having a and b as length of parallel sides and h as the perpendicular distance between parallel sides.
  - Area of a trapezium, $A = (1/2)(a+b) \times h$

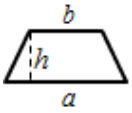

Figure 10.13: A Trapezium

- **Regular Hexagon:** A regular hexagon is actually a combination of six equilateral triangles of all of side 'a'. As shown in Fig. 10.14, a regular hexagon having a as its side lengths
  - Area of a regular hexagon, $A = \left(3\sqrt{3}/2\right)a^2$
  - For a regular hexagon, the circum-radius is and in-radius

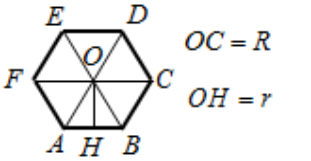

Figure 10.14: A Regular Hexagon

Circles: A circle of radius r (or diameter d) shown in Fig. 10.15.

- Area of a circle, $A = \pi r^2 = (1/4)\pi d^2$
- Circumference of circle, $C = 2\pi r = \pi d$

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- Arc length, AB is the minor arc and ACB is the major arc, $AB = L = \left(\theta/360^o\right) \times 2\pi r$.
- Two circles are said to be congruent iff they have same radii.
- **Sector of a circle:** It is a part of the area of a circle between two radii. As shown in Fog. 10.15, the shaded region is the minor sector and the rest is major sector.
  - For a minor sector, of length L, of a circle of radius r, making an angle θ at the centre of the circle, as shown in Fig. 10.15, area of minor sector of a circle, $A = \theta\pi r^2/360^o$.

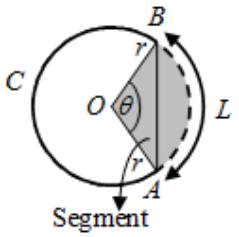

Figure 10.15: A Circle

- **Segment:** A minor sector minus the triangle formed by to radii is called the segment of the circle, as shown in Fig. 10.15.
  - The area of segment, $A_{seg} = \left\{\theta\pi r^2/360^o\right\} - (1/2)r^2 \sin\theta$
  - Perimeter of segment is the sum of length of arc and length of segment AB, i.e. Perimeter of segment $= \left\{\theta(2\pi r)/360^o\right\} + 2r\sin\left(\theta/2\right)$.

The following are the properties related to a circle:

- The perpendicular from the centre of a circle to a chord bisects the chord.
- The perpendicular bisector of two chords of a circle intersects at its centre.
- There can be only one circle passing through three or more non-collinear points.
- If two circles intersect in two points then the line through the centres is the perpendicular bisector of the common chord.
- If two chords of a circle are equal, then the centre of the circle lies on the angle bisector of the two chords. Equal chords of a circle or congruent circles are equidistant from the centre.
- Equidistant chords from the centre of a circle are equal to each other in terms of their length.
- The degree measure of an arc of a circle is twice the angle subtended by it any point on the alternate segment of the circle, i.e. as shown in Fig. 10.16, with respect to the arc AB, $\angle AOB = 2\angle ADB$. Any two angles in the same segment are equal, i.e. with respect to the arc AB, $\angle ADB = \angle ACB$.
- The angle subtended by a semi-circle is a right angle.
- Any angle subtended by a minor arc in the alternate segment is acute, and any angle subtended by a major arc in the alternate segment is obtuse, i.e. as shown in Fig. 10.16, $\alpha = 2\angle ADB$ and $\beta = 2\angle AEB$. As $\alpha + \beta = 360^o \Rightarrow \angle ADB + \angle AEB = 180^o$. Thus the sum of opposite angle of a cyclic quadrilateral is 180^o.

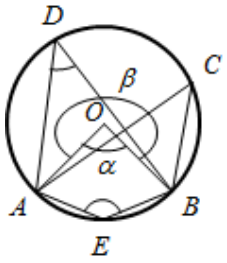

Figure 10.16: Measure of angle w.r.t. arc

- If a line segment joining two points subtends equal angles at two other points lying on the same side of the line, the four points are concyclic.
- Equal chords of a circle subtend equal angles at the centre.
- If a circle touches all the four sides of a quadrilateral then the sum of two opposite sides is equal to the sum of other two.

Cuboid: A cuboid is a three dimensional box. For a cuboid having l is the length, b is the breadth, h is the height of a cuboid, as shown in Fig. 10.17,

- Total surface area of a cuboid, $S = 2(lb + bh + lh)$; Volume of cuboid, $V = lbh$
- Length of diagonal of cuboid, $L = \sqrt{l^2 + b^2 + h^2}$

Cube: A cube is a cuboid in which all the three sides are equal. For a cube having l as its side length, as shown in Fig. 10.18,

- Total surface area of cube, $S = 6l^2$; Volume of cube, $V = l^3$
- Length of diagonal of cube, $L = \sqrt{3}\,l$

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Cylinder: It is a solid which has both its ends in the form of a circle. For a cylinder having r as its radius of base and h as its height, as shown in Fig. 10.19,

- Curved surface area of cylinder, $C = 2\pi rh$; Volume of cylinder, $V = \pi r^2 h$
- Total surface area of a cylinder, $S = 2\pi r(r+h)$

Hollow Cylinder: For a hollow cylinder having R as its outer radius, r as its inner radius, and h as its height, as shown in Fig. 10.20,

- Volume of hollow cylinder, $V = \pi rh(R^2 - r^2)$

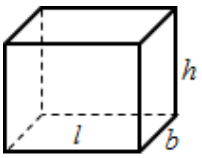

Figure 10.17: A Cuboid

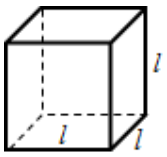

Figure 10.18: A Cube

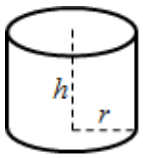

Figure 10.19: A Cylinder

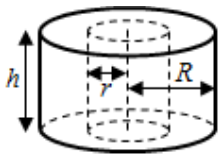

Figure 10.20: A hollow cylinder

Prism: A prism is a solid which can have any polygon at both its ends. Its dimension are defined by the dimensions of the polygon at its ends and its height.

- Lateral surface area of a right prism = Perimeter of base × Height
- Volume of a right prism = Area of base × Height
- Whole surface area of a right prism = Lateral surface area + the area of the two plane ends

Pyramid: A pyramid is a solid which can have any polygon as its base and its edges converge to a single apex. Its dimensions are defined by the dimensions of the polygon as its base and the length of its lateral edges which lead to the apex.

- Slant surface area of Pyramid = $(1/2) \times$ (Perimeter of the base) × (Slant height)
- Whole surface area of Pyramid = Slant surface area + Area of the base
- Volume of a Pyramid = $(1/3) \times$ (Area of the base) × (height)

Cone: A cone is a solid which has a circle at its base and a slanting lateral surface that converges at the apex. For a cone having r as the radius, l as its slant height and h as its height (perpendicular of base), as shown in Fig. 10.21,

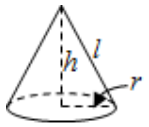

Figure 10.21: A Cone

- Area of base of a cone, $A = \pi r^2$
- Curved surface area of a cone, $C = \pi rl$
- Total surface area of a cone, $S = \pi r(r+l)$
- Volume of right circular cone, $V = (1/3)\pi r^2 h$

Frustum of a Cone: When a cone is cut the left over part is called frustum of cone. For a frustum of right circular cone having r as upper base radius, R as lower base radius, l as slant height, as shown in Fig. 10.22

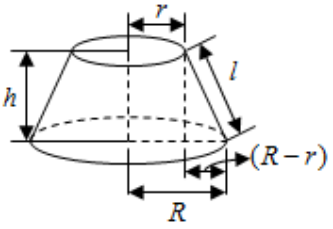

Figure 10.22: Frustum of Cone

- Volume of frustum of right circular cone, $V = (1/3)\pi h(r^2 + rR + R^2)$
- Curved surface area, $C = \pi(r+R)l = \pi(r+R)\sqrt{(R-r)^2 + h^2}$
- Total surface area, $S = \pi(r+R)l + \pi r^2 + \pi R^2$, where $l = \sqrt{(R-r)^2 + h^2}$

Sphere: It is a solid in the form of a ball. For a sphere having r as its radius or d as its diameter, as shown in Fig. 10.23,

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- Surface area of sphere, $S = 4\pi r^2 = \pi d^2$
- Volume of sphere, $V = (4/3)\pi r^3 = (1/6)\pi d^3$

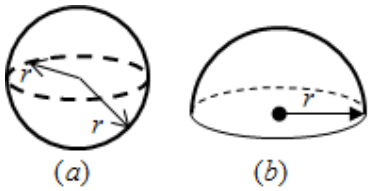


Figure 10.23: (a) Sphere (b) Hemi-Sphere

Hemi-sphere: For a hemisphere of radius r, as shown in Fig. 10.24,

- Curved surface area of a Hemisphere, $C = 2\pi r^2$
- Total surface area of a Hemisphere, $S = 3\pi r^2$
- Volume of a Hemisphere, $S = (2/3)\pi r^3 = (1/12)\pi d^3$

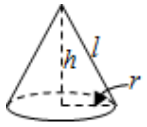
Now let us consider some examples:

Example [GA-2014 (2 marks)]: The smallest angle of a triangle is equal to two thirds of the smallest angle of a quadrilateral. The ratio between the angles of the quadrilateral is 3:4:5:6. The largest angle of the triangle is twice its smallest angle. What is the sum, in degrees, of the second largest angle of the triangle and the largest angle of the quadrilateral? _____

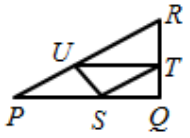
Solution: Let the angles of a quadrilateral are $3x, 4x, 5x, 6x$; since the sum of interior angles of any quadrilateral is 360^o; so $3x + 4x + 5x + 6x = 360^o \Rightarrow x = 20^o$. Thus largest angle of quadrilateral is $6 \times 20^o = 120^o$; smallest angle of quadrilateral is $3 \times 20^o = 60^o$; and smallest angle of triangle is $\frac{2}{3} \times 60^o = 40^o$. Thus the largest angle of triangle is $2 \times 40^o = 80^o$ and so the second largest angle of a triangle is $180^o - 80^o - 40^o = 60^o$. Hence the sum of largest angle of quadrilateral and second largest angle of triangle is $120^o + 60^o = 180^o$. So answer is 180.

Example [GA-2015 (2 marks)]: From a circular sheet of paper of radius 30 cm, a sector of 10% area is removed. If the remaining part is used to make a conical surface, then the ratio of the radius and height of the cone is _____.

Solution: As the area of circular sheet of radius 30 cm is $A = \pi r^2 = \pi(30)^2 = 900\pi$. After removing a sector of 10% area of 900π cm^2, the remaining part is used to make a conical surface, i.e. 90% of $900\pi = \pi r l$, where r is radius of base of cone and l its slant height. As $l = 30$ cm, so $0.9 \times 900\pi = \pi \times r \times 30 \Rightarrow r = 27$ cm. So $h = \sqrt{l^2 - r^2} = \sqrt{30^2 - 27^2} = 13.08$. Hence the required ratio is $\frac{r}{h} = \frac{27}{13.08} = 2.06$.



Example [GA-2015 (2 marks)]: In the given figure angle Q is a right angle, $PS:QS = 3:1$, $RT:QT = 5:2$, $PU:UR = 1:1$. If area of triangle QTS is 20 cm^2, then the area of triangle PQR in cm^2 is _____.



Solution: $PS:QS = 3:1 \Rightarrow QS/PQ = 1/(1+3) = 1/4$; $RT:QT = 5:2 \Rightarrow QT/QR = 2/(2+5) = 2/7$.

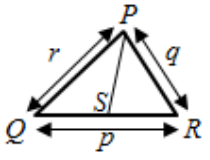
Now area of $\Delta QTS = \frac{1}{2} \times SQ \times QT = \frac{1}{2} \times \left(\frac{1}{4}PQ\right) \times \left(\frac{2}{7}QR\right) = \frac{1}{14} \times \left(\frac{1}{2}PQ \times QR\right) = \frac{1}{14} \times$ area of ΔPQR

$\Rightarrow$ area of $\Delta PQR = 14 \times$ (area of ΔQTS) $\Rightarrow$ area of $\Delta PQR = 14 \times 20 = 280$ cm^2.

Example [GA-2015 (2 marks)]: In a triangle PQR, PS is the angle bisector of $\angle QPR$ and $\angle QPS = 60^o$. What is the length of PS?

(a) $(q+r)/qr$ (b) $qr/(q+r)$

(c) $\sqrt{q^2 + r^2}$ (d) $(q+r)^2/qr$



Solution (b): As PS is the angle bisector of $\angle QPR$, so

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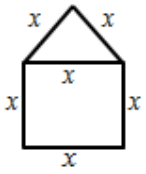
$\frac{QS}{SR}=\frac{r}{q}\Rightarrow\frac{QS}{p-QS}=\frac{r}{q}\Rightarrow QS=\frac{rp}{r+q}$, since $QS+SR=p$. Now in triangle QPS, applying sine rule, we get $\frac{\text{PS}}{\sin\text{Q}}=\frac{\text{QS}}{\sin\text{P}}\Rightarrow\text{PS}=\text{QS}\times\frac{\sin\text{Q}}{\sin\text{P}}=\text{QS}\times\frac{\sin\text{Q}}{\sin 60^o}=2\text{QS}\times\sin\text{Q}\Rightarrow\text{PS}=2\frac{rp}{r+q}\times\sin\text{Q}$ …(i). Again in triangle, PQR, applying sine rule, we get $\frac{\text{PR}}{\sin\text{Q}}=\frac{\text{QR}}{\sin\text{P}}\Rightarrow\text{PR}=\text{QR}\times\frac{\sin\text{Q}}{\sin\text{P}}=p\times\frac{\sin\text{Q}}{\sin 60^o}\Rightarrow q=2p\times\sin\text{Q}$ …(ii). On dividing (i) by (ii), we get $\text{PS}/q=r/(r+q)\Rightarrow\text{PS}=rq/(r+q)$.

Example [GA-2016 (1 mark)]: A window is made up of a square portion and an equilateral triangle portion above it. The base of the triangular portion coincides with the upper side of the square. If the perimeter of the window is 6 m, the area of the window in m^2 is _____.

(a) 1.43 (b) 2.06 (c) 2.68 (d) 2.88



Solution (b): As the triangle is equilateral and base of the triangular portion coincides with the upper side of the square, so length of side of the triangle is same as the length of side of square. Now, let side of equilateral triangle is 'x', so from the figure, perimeter of window will be $5x=6\Rightarrow x=1.2\,\text{m}$. Hence area of the window will be the sum area of area of square and equilateral triangle. Thus required area $=1.2^2+(\sqrt{3}/4)1.2^2=1.44+0.623=2.06\ \text{m}^2$. So option (b) is correct.

Example [GA-2016 (1 mark)]: A cube is built using 64 cubic blocks of side one unit. After it is built, one cubic block is removed from every corner of the cube. The resulting surface area of the body (in square units) after the removal is _____.

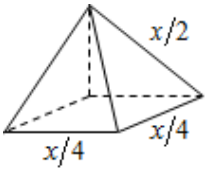
(a) 56 (b) 64 (c) 72 (d) 96

Solution (d): If a cube is built using 64 cubic blocks of side one unit, then volume of bigger cube is same as volume of 64 cubic blocks of side one unit. Let side length of bigger cube is 'x', so we have $x^3=64(1)^3\Rightarrow x=4$. Thus, surface area of bigger cube $=6(4)^2=96$.

Now if corner cubes are removed, three exposed surfaces are removed which will create three new surfaces in original large cube. So surface area will remain unchanged, i.e. 96.

Example [GA-2016 (2 marks)]: A square pyramid has a base perimeter x, and the slant height is half of the perimeter. What is the lateral surface area of the pyramid?

(a) x^2 (b) $0.75x^2$ (c) $0.50x^2$ (d) $0.25x^2$



Solution (d): As base perimeter of square pyramid is $p=x$. So its side is $p/4=x/4$. Slant height $l=x/2$. So Lateral surface area of pyramid $=\frac{1}{2}\times\text{Base perimeter}(p)\times\text{slant height}(h)=\frac{1}{2}\times x\times\frac{x}{2}=\frac{x^2}{4}=0.25x^2$

Exercise 10.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1.	A man wants to cut three lengths from a single piece of boards of length 123 cm. The second length is to be 3 cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths (x) for the shortest board, if the third piece is to be at least 5 cm longer than the second? (a) $5\le x\le 24$ (b) $8\le x\le 24$ (c) $6\le x\le 24$ (d) $7\le x\le 24$
2.	One cubic metre piece of copper is melted and recast into a square cross section bar 36 m long. An exact cube is cut off from this bar. If 1 m^3 of copper cost ₹ 108, then the cost of the

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	cube (in ₹) is _____
3.	A circular ring of radius 3 cm is suspended horizontally from a point 4 cm vertically above the centre by 4 strings attached at equal intervals to its circumference. If the angle between two consecutive strings is θ, then $\cos\theta$ is _____
4.	A reservoir is in the shape of a frustum of a right circular cone. It is 8 m across at the top and 4 m across the bottom. It is 6 m deep. Find the area (in m^2) of its curved surface. _____
5.	Twenty nine times the area of a square is one square metre less than six times the area of the second square and nine times the side of it exceeds the perimeter of other square by one metre. The difference in sides (in m) of these squares is _____
6.	A sector of a circle of radius 15 cm has the angle 120^o. It is rolled up so that two bounding radii are joined together to form a cone. The volume of the cone is (a) $250\sqrt{2}\pi$ cm^3 (b) $500\sqrt{2}\pi/3$ cm^3 (c) $250\sqrt{2}\pi/3$ cm^3 (d) $1000\sqrt{2}\pi/3$ cm^3
7.	A toy is in the shape of a hemisphere surmounted by a cone. If radius of the cone is 3 cm and its height is 4 cm, the total surface area of the toy is _____ π cm^2.
8.	A cylindrical container of height 14 m and base diameter 12 m contains oil. This oil is to be transferred to one cylindrical can, one conical can and a spherical can. The base radius of all the containers is same. The height of the conical can is 6 cm. While pouring some oil is dropped and hence only 75% of cylindrical can could be filled. How much oil is dropped? (a) 54π m^3 (b) 36π m^3 (c) 46π m^3 (d) 50π m^3
9.	A cylindrical tub of radius 12 cm contains water up to a depth of 20 cm. A spherical iron ball is dropped into the tub and thus the level of water is raised by 6.75 cm. The radius (in cm) of the ball is _____.
10.	The length of a rectangular field is double its width. Inside the field, there is a square-shaped pond 8 m long. If the area of the pond is $1/8^{th}$ of the area of the field, what is the length (in m) of the field? _____.
11.	A garden is 24 m long and 14 m wide. There is a path 1 m wide outside the garden along its sides. If the path is to be constructed with square marbles tiles 20 cm by 20 cm, find the number of tiles required to cover the path. _____
12.	A cylinder is filled to $4/5^{th}$ of volume. It is, then tilted so that the level of water coincides with one edge of its bottom and top edge of the opposite side. In the process, 30 cc of the water is spilled. What is the volume (in cc) of the cylinder? _____
13.	The length and breadth of a playground are 36 m and 21 m respectively. Poles are required to be fixed all along the boundary at a distance 3 m apart. The number of poles required will be _____.
14.	If the radius of circle is increased by 50%, then the area of the circle is increased by how much percentage (in %)? _____
15.	The area of the largest circle, that can be drawn inside a rectangle with side 18 cm by 14 cm is _____ cm^2.
16.	2 cm of rain has fallen on a square km of land. Assuming that 50% of raindrops could have been collected and contained in a pool having a 100 m $\times$ 100 m base, by what level would the water level in the pool have increased? (a) 15 m (b) 20 m (c) 10 m (d) 25 m
17.	The perimeter of a right angled triangle is 60 cm. Its hypotenuse is 26 cm. The area (in cm^2) of the triangle is _____.
18.	Dimension of a cuboid are 25 cm $\times$ 20 cm $\times$ 4 cm. The volume of a cube is half the volume of the cuboid. Total surface area of such a cube is _____ cm^2.
19.	How many small cubes, each of 96 cm^2 surface area, can be formed from the material obtained by melting a larger cube if 384 cm^2 surface area? _____
20.	If the areas enclosed by a circle or a square and an equilateral triangle be the same, then the maximum perimeter is possessed by (a) circle (b) square (c) equilateral triangle (d) both triangle and square
21.	Four horses are tied on the four corners of a square field of 14 m length so that each horse can just touch the other two horses. They were able to graze in the area accessible to them for 11

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days. For how many days is the un-grazed area sufficient for them? _____

22. The sides of a triangle are in the ratio $\frac{1}{2}:\frac{1}{3}:\frac{1}{4}$. If the perimeter is 52 cm, then the length of the smallest side is _____ cm.

23. A large cube is formed from the material obtained by melting three smaller cubes of 3, 4 and 5 cm side. What is the ratio of the total surface areas of the smaller cubes and the larger cubes?
(a) $2:1$ (b) $3:2$ (c) $27:20$ (d) $25:18$

24. If the perimeter of an isosceles triangle is $(6+3\sqrt{2})$m, then the area of the triangle is _____ m^2.

25. A solid cylinder and a solid cone have equal base and equal height. If the radius and the height be in the ratio $4:3$, the ratio of the total surface area of the cylinder to that of the cone is in the ratio of
(a) $10:9$ (b) $11:9$ (c) $12:9$ (d) $14:9$

26. An ice-cream company makes a popular brand of ice-cream in rectangular shaped bar 6 cm long, 5 cm wide and 2 cm thick. To cut costs, the company has decided to reduce the volume of the bar by 20% the thickness will remain the same, but the length and width will be decreased by the same percentage amount. The new length L will satisfy
(a) $5.5 \le L \le 6$ (b) $5 \le L \le 5.5$ (c) $4.5 \le L \le 5$ (d) $4 \le L \le 4.5$

27. How many circular plates of diameter d be taken out of a square plate of side $2d$ with minimum loss of material? _____

28. What is the total area of three equilateral triangles inscribed in a semi-circle of radius 2 cm?
(a) 12 cm^2 (b) $2\sqrt{3}$ cm^2 (c) $\sqrt{3}$ cm^2 (d) $3\sqrt{3}$ cm^2

29. The area of a sector of a circle of radius 36 cm is 72π cm^2. The length of the corresponding arc of the sector is
(a) π cm (b) 2π cm (c) 3π cm (d) 4π cm

30. A square is inscribed in a circle of diameter $2a$ and another square is circumscribing circle. The difference between the areas of outer and inner squares is
(a) a^2 (b) $2a^2$ (c) $3a^2$ (d) $4a^2$

31. Consider an equilateral triangle of a side of 1 m. A new equilateral triangle is formed by joining the mid-points of one, then a third equilateral triangle is formed by joining the mid-points of second. The process is continued. The perimeter (in m) of all triangles, thus formed is approximately _____.

32. What is the area of the larger segment of a circle formed by a chord of length 5 cm subtending an angle of 90^o at the centre?
(a) $\frac{25}{4}\left(\frac{\pi}{2}+1\right)\text{cm}^2$ (b) $\frac{25}{4}\left(\frac{\pi}{2}-1\right)\text{cm}^2$ (c) $\frac{25}{4}\left(\frac{3\pi}{2}+1\right)\text{cm}^2$ (d) $\frac{25}{4}\left(\frac{3\pi}{2}-1\right)\text{cm}^2$

33. A rectangle of maximum area is drawn inside a circle of diameter 5 cm. What is the maximum area (in cm^2) of such a rectangle?

34. What is the area (in cm^2) of a circle whose area is equal to that of a triangle with sides 7 cm, 24 cm and 25 cm? _____

35. A rectangular field is 22 m long and 10 m wide. Two hemispherical pit-holes of radius 2 m are dug from two places and the mud is spread over the remaining part of the field. The rise in the level of the field is _____.
(a) $8/93$ m (b) $13/93$ m (c) $16/93$ m (d) $23/93$ m

36. A hospital room is to accommodate 56 patients. It should be done in such a way that every patient gets 2.2 m^2 of floor and 8.8 m^3 of space. If the length of the room is 14 m, then breadth and the height of the room are respectively
(a) 8.8 m, 4 m (b) 8.4 m, 4.2 m (c) 8 m, 4m (d) 7.8 m, 4.2 m

37. What is the area (in cm^2) between a square of side 10 cm and two inverted semi-circular, cross-sections each of radius 5 cm inscribed in the square? _____

38. The short hand and long hands of a clock are 4 cm and 6 cm long, respectively. Then, the ratio

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of distances travelled by tips of short hand in 2 days and long hand in 3 days is
(a) $4:9$ (b) $2:9$ (c) $2:3$ (d) $1:27$

39. The area enclosed between the circumferences of two concentric circles is 16π cm^2 and their radii are in the ratio $5:3$. The area of the outer circle is _____ $\times\pi$ cm^2.

40. The circumference of a circle is equal to perimeter of square. If A_c is the area of circle and A_s is the area of square, then which one of the following is true?
(a) $A_c = A_s$ (b) $A_c \geq A_s$ (c) $A_c > A_s$ (d) $A_c < A_s$

41. The lengths of two sides of a right angled triangle which contain the right angle are a and b, respectively. Three squares are drawn on the three sides of the triangle on the outer side. What is the total area of the triangle and the three squares?
(a) $2(a^2+b^2)+ab$ (b) $2(a^2+b^2)+2.5ab$ (c) $2(a^2+b^2)+0.5ab$ (d) $2.5(a^2+b^2)$

42. A grassy field has the shape of an equilateral triangle of side 6 m. A horse is tied to one of its vertices with a rope of length 4.2 m. The percentage (in %) of the total area of the field which is available for grazing is best approximated by _____.

43. Three congruent circles each of radius 4 cm touch one another. What is the area (in cm^2) of the portion included between them?
(a) 8π (b) $16\sqrt{3}-8\pi$ (c) $16\sqrt{3}-4\pi$ (d) $16\sqrt{3}-2\pi$

44. The two diagonals of a rhombus are of lengths 55 cm and 48 cm. If p (in cm) is the perpendicular height of the rhombus, then which one of the following is correct?
(a) $36 < p < 37$ (b) $35 < p < 36$ (c) $34 < p < 35$ (d) $33 < p < 34$

45. What is the maximum area (in cm^2) of a rectangle, the perimeter of which is 18 cm?
(a) 20.25 (b) 20 (c) 19.75 (d) 19.60

46. Three circular laminas of the same radius are cut out from a larger circular lamina. When the radius of each lamina cut out is the largest possible, then what is the ratio (approximate) of the area of the residual piece of the original lamina to its original total area?
(a) $0.30:1$ (b) $0.35:1$ (c) $0.40:1$ (d) $0.45:1$

47. A chord AB of a circle of radius 20 cm makes a right angle at the centre of the circle. What is the area of the minor segment in cm^2? _____

48. A circle is inscribed in an equilateral triangle of side 1 m. What is the area (in m^2) of any square inscribed in this circle?

49. If 64 identical small spheres are made out of big sphere of diameter 8 cm, then what is surface area of each small sphere?
(a) π cm^2 (b) 2π cm^2 (c) 3π cm^2 (d) 4π cm^2

50. A cone of radius r cm and height h cm is divided into two parts by drawing a plane through the middle point of its height and parallel to the base. What is the ratio of the volume of the original cone to the volume of the smaller cone?
(a) $4:1$ (b) $8:1$ (c) $2:1$ (d) $6:1$

51. A cube has each edge 2 cm and cuboid is 1 cm long, 2 cm wide and 3 cm high. The paint in a certain container is sufficient to paint an area equal to 54 cm^2. Which one of the following statement is correct?
(a) Both cube and cuboid can be painted (b) Only cube can be painted
(c) Only cuboid can be painted (d) Neither cube nor cuboid can be painted

52. For a plot of land of 100 m $\times$ 80 m, the length to be raised by spreading the earth from stack of a rectangular base 10 m $\times$ 8 m and vertical section being a trapezium of height 2 m. The top of the stack is 8 m $\times$ 5 m. How many centimetres can the level raised? _____

53. If x is the curved surface area and y is the volume of a right circular cylinder, then which one of the following is correct?
(a) Only the ratio of height to radius of the cylinder is independent of x
(b) Only the ratio of height to radius of the cylinder is independent of y
(c) Either (a) or (b)
(d) Neither (a) nor (b)

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54. Let A be a pyramid on a square base and B be a cube. If a, b and c denote the number of edges, faces and corners, respectively. Then, the result $a = b + c$ is true for
(a) only A (b) only B (c) both A and B (d) neither A nor B

55. From a solid wooden right circular cylinder, a right circular cone whose radius and height are same as the radius and height of the cylinder, respectively, is carved out. What is the ratio of the volume of the utilised wood to that of the wasted wood?
(a) 1 : 2 (b) 2 : 1 (c) 2 : 3 (d) 1 : 3

56. A cylinder is surmounted by a cone at one end, a hemisphere at the other end. The common radius is 3.5 cm, the height of the cylinder is 6.5 cm and the total height of the structure is 12.8 cm. The volume of the structure is _____ cm^3.

57. A bucket is of height 25 cm. Its top and bottom radii are 20 cm and 10 cm, respectively. Its capacity (in litres) is _____.

58. A cylindrical tube open at both ends is made of metal. The internal diameter of the tube is 6 cm and length of the tube is 10 cm. If the thickness of the metal used is 1 cm, then the outer curved surface area of the tube is _____.
(a) 68π cm^2 (b) 70π cm^2 (c) 83π cm^2 (d) 96π cm^2

59. The volume (in cm^3) of the material of a hemispherical shell with outer and inner radii 9 cm and 7 cm, respectively, is approximately
(a) 808.76 (b) 800.56 (c) 816 (d) 825

60. What is the volume (in cm^3) of the largest sphere that can be carved out of a cube of edge 3 cm?
(a) 4.5π (b) 6π (c) 7.5π (d) 9π

61. The volume of a cube is numerically equal to sum of its edges. What is the total surface area in square units? _____

62. Let the largest possible right circular cone and largest possible sphere be fitted into two cubes of same length. If V_C and V_S denotes the volume of cone and volume of sphere, respectively. Then, which one of the following is correct?
(a) $V_C = 2V_S$ (b) $V_S = 2V_C$ (c) $V_S = V_C$ (d) $V_C = 3V_S$

63. 10 circular plates each of thickness 3 cm, each are placed one above the other and a hemisphere of radius 6 cm is placed on the top just to cover the cylindrical solid. What is the volume of the solid so formed?
(a) 260π cm^3 (b) 250π cm^3 (c) 500π cm^3 (d) 1224π cm^3

64. A cardboard sheet in the form of a circular sector of radius 30 cm and central angle 144^o is folded to make a cone. What is the radius (in cm) of the cone? _____

65. What will be the cost (in ₹) to plaster the inner surface of well 14 m deep and 4 m in diameter at the rate of ₹ 25 per square metre?

66. A hollow sphere of internal and external diameters 4 cm and 8 cm, respectively, is melted into a cone of base diameter 8 cm. What is the height (in cm) of the cone?

67. A figure is formed by revolving a rectangular sheet of dimensions 7 cm × 4 cm about its length. What is the volume (in cm^3) of the figure, thus formed? _____

68. The diagonals of the three faces of a cuboid are x, y and z, respectively. What is the volume of the cuboid?
(a) $\dfrac{xyz}{2\sqrt{2}}$ (b) $\dfrac{\sqrt{(y^2+z^2)(z^2+x^2)(x^2+y^2)}}{2\sqrt{2}}$
(c) $\dfrac{\sqrt{(y^2+z^2-x^2)(z^2+x^2-y^2)(x^2+y^2-z^2)}}{2\sqrt{2}}$ (d) None of these

69. Half of a large cylindrical tank open at the top is filled with water and identical heavy spherical balls are to be dropped into the tank without spilling water out. If the radius and the height of the tank are equal and each is four times the radius of a ball, then what is the maximum number of balls that can be dropped?

70. The length, breadth and height of a rectangular parallelepiped are in ratio 6 : 3 : 1. If the

surface area of a cube is equal to the surface area of this parallelepiped, then what is the ratio of the volume of the cube to the volume of the parallelepiped?
(a) 1 : 1 (b) 5 : 4 (c) 7 : 5 (d) 3 : 2

71. A semi-circular thin sheet of a metal of diameter 28 cm is bent and an open conical cup is made. What is the capacity of the cup?
(a) $\frac{1000}{\sqrt{3}}\text{cm}^3$ (b) $300\sqrt{3}\text{ cm}^3$ (c) $\frac{700}{\sqrt{3}}\text{cm}^3$ (d) $\frac{1078}{\sqrt{3}}\text{cm}^3$

72. Smaller lead shots are to be prepared by using the material of a spherical lead shot of radius 1 cm. Some possibilities are listed in the statements given below:
(i) The material is just sufficient to prepare 8 shots each of radius 0.5 cm
(ii) A shot of radius 0.75 cm and a second shot of radius 0.8 cm can be prepared from the available material.
Which of the above statements is/are correct
(a) only (i) (b) only (ii) (c) both (i) and (ii) (d) neither (i) nor (ii)

73. A hemisphere is made of a sheet of a metal 1 cm thick. If the outer radius is 5 cm, what is the weight of the hemisphere (1 cm^3 of the metal weight 9 grams)?
(a) 54π grams (b) 366π grams (c) 122π grams (d) 108π grams

74. The paint in certain container is sufficient to paint an area equal to 5.875 m^2. How many bricks of dimensions 12.5 cm × 10 cm × 7.5 cm can be painted out of this container? _____

75. A triangle with sides 5 cm, 12 cm and 13 cm is revolved about the side 12 cm. What is the volume of the solid generated?
(a) $50\pi\text{ cm}^3$ (b) $75\pi\text{ cm}^3$ (c) $100\pi\text{ cm}^3$ (d) $125\pi\text{ cm}^3$

76. How many litres of water flow out of a pipe having an area of cross-section of 5 cm^3 in one minute, if the speed of water in the pipe is 30 cm/s?

77. How many litres of water (approximately) can a hemispherical container of radius 21 cm hold? _____

78. From a cylindrical log whose height is equal to its diameter, the greatest possible sphere has been taken out. What is the fraction of the original log which is cut away?
(a) $1/2$ (b) $1/3$ (c) $1/4$ (d) $2/3$

79. From a solid cube of edge 3 m, a solid of largest sphere is carved out. What is the volume (in m^3) of solid left?
(a) $27 - 2.25\pi$ (b) $27 - 4.5\pi$ (c) 2.25π (d) 4.5π

80. A cone is inscribed in a hemisphere such that their bases are common. If C is the volume of cone and H that of the hemisphere, then what is the value of $C : H$?
(a) 1 : 2 (b) 2 : 3 (c) 3 : 4 (d) 4 : 5

81. If the diameter of a wire is decreased by 10%, by how much percentage (in %) will the length be increased to keep the volume constant? _____

82. If $PQRS$ be a rectangle such that $PQ = \sqrt{3}QR$. Then, $\angle PRS$ is _____ degrees.

83. In a trapezium, the two non-parallel sides are equal in length, each being of 5 cm. The parallel sides are at a distance of 3 cm apart. If the smaller side of the parallel sides is of length 2 cm, then the sum of the diagonals of the trapezium is
(a) $10\sqrt{5}$ cm (b) $6\sqrt{5}$ cm (c) $5\sqrt{5}$ cm (d) $3\sqrt{5}$

84. The area of the rectangle lies between 40 cm^2 and 45 cm^2. If one of the sides is 5 cm, then its diagonal lies between
(a) 8 cm and 10 cm (b) 9 cm and 11 cm (c) 10 cm and 12 cm (d) 11 cm and 13 cm

85. If the diagonals of a rhombus are 4.8 cm and 1.4 cm, then what is the perimeter (in cm) of the rhombus?

86. $ABCD$ is a trapezium with parallel sides $AB = 2\,\text{cm}$ and $DC = 3\,\text{cm}$. E and F are the mid-points of the non-parallel sides. The ratio of area of $ABFE$ to area of $EFCD$ is
(a) 9 : 10 (b) 8 : 9 (c) 9 : 11 (d) 11 : 9

87. The sides of a parallelogram are 12 cm and 8 cm long and one of the diagonals is 10 cm long. If d (in cm) is the length of other diagonal, then which one of the following is correct?

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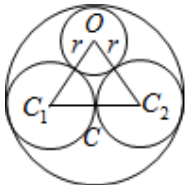
	(a) $d < 8$ (b) $8 < d < 10$ (c) $10 < d < 12$ (d) $d > 12$
88.	Let $LMNP$ be a parallelogram and NR be perpendicular to LP. If the area of the parallelogram is six times the area of ΔRNP and $RP = 6$ cm, then what is LR (in cm)?
89.	Two poles of heights 6 m and 11 m stand vertically upright on a plane ground. If the distance between their feet is 12 m, what is the distance (in m) between their tops?
90.	An equilateral triangle and a regular hexagon are inscribed in a given circle. If a and b are the lengths of their sides respectively, then which one of the following is correct? (a) $a^2 = 2b^2$ (b) $b^2 = 3a^3$ (c) $b^2 = 2a^2$ (d) $a^2 = 3b^2$
91.	The floor area of Kapil's house is 1007 square metre. The space diagonal of the house is 59.75 metre. What will be the height (in m) of the house? Note that floor is rectangle in shape. Also, length and width are integer. _____
92.	To move a Safe, two cylindrical steel bars 7 cm in diameter are used as rollers. How far (in cm), approximately, will the safe have moved forward when the rollers have made one revolution? _____
93.	Assume for a moment that the earth is a perfectly uniform sphere of radius 6400 km. Suppose a thread equal to the length of the circumference of the earth was placed along the equator, and drawn to a tight fit. Now suppose that the length of the thread is increased by 12 cm, and that it is pulled away uniformly in all directions. By how many cm, approximately, will the thread be separated from the earth's surface? _____
94.	There is a perfect sphere of diameter 40 cm resting up against a perfectly straight wall and a perfectly straight floor i.e. the wall and the floor make a perfect right angle. Can a perfect sphere of diameter 7 cm pass through the space between the big sphere, the wall and the floor? (a) Yes (b) No (c) Data insufficient (d) None of these
95.	What is the area (in sq. units) of the triangle ABC with $A(e, \pi)$, $B(2e, 3\pi)$ and $C(3e, 5\pi)$?
96.	A, B and C are three points on a straight line, not necessarily equidistant with B being between A and C. Three semicircles are drawn on the same side of the line with AB, BC and AC as the diameters. BD is perpendicular to the line ABC, and D lies on the semicircle AC. If the funny shaped diagram between the three semicircles has an area of 1000 square cm, find the length (in cm) of BD. _____
97.	One side of the bottom layer of a triangular pyramid has 12 balls. How many are there in the whole pyramid? Note that the pyramid is equilateral and solid. _____

Exercise 10.2

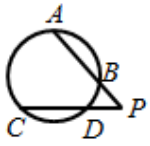
In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. Two circles of unit radius touch each other and each of them touches internally a circle of radius two units, as shown in the figure. The radius of the circle which touches all the three circles is _____ units.

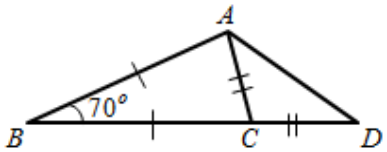


(a) $\frac{3}{2}$ (b) $\frac{2}{3}$ (c) $\frac{5}{6}$ (d) $\frac{6}{5}$

2. In the following figure, $PA = 8$ cm, $PD = 4$ cm, $CD = 3$ cm, then the length (in cm) of AB is _____.

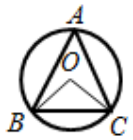


3. In the following figure, $\angle ADC$ is _____.

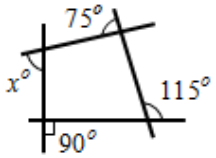


(a) 55^o (b) 27.5^o (c) 60^o (d) 30^o

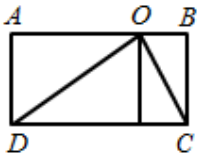
4. In the figure given below, O is the centre of the circle. If $\angle OBC = 37^o$, the $\angle BAC$ (in degrees) is _____.



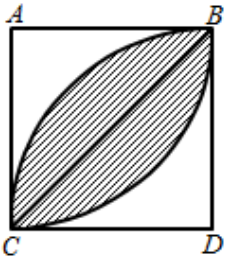
5. The sides of a quadrilateral are extended to make the angles as shown in figure. What is the value of x?



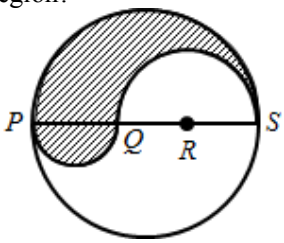
6. In the figure given below, the area of rectangle $ABCD$ is 100 cm^2. O is any point on AB and $CD = 20$ cm. Then, the area (in cm^2) of ΔCOD is _____.



7. In the given figure, the side of square $ABCD$ is 7 cm. What is the area (in cm^2) of the dotted portion which is formed by the arcs BC of the circles with centre at D and A

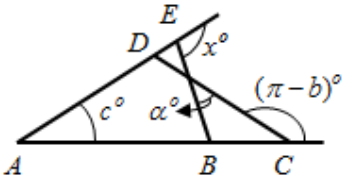


8. $PQRS$ is a diameter of a circle of radius 6 cm, as shown in the figure. The length PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS as diameters. What is the perimeter (in cm) of the shaded region?



(a) 12π (b) 14π (c) 16π (d) 18π

9. The angles x^o, a^o, c^o and $(\pi - b)^o$ are indicated in the figure given below:

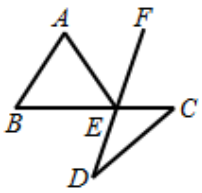


Which of the following is correct?

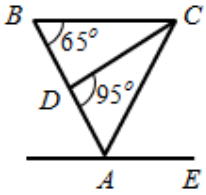
(a) $x = a + c - b$ (b) $x = b - a - c$

(c) $x = a + b + c$ (d) $x = a - b + c$

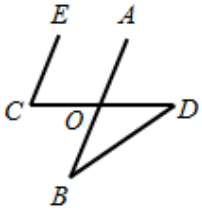
10. In the figure given below, AB is parallel to CD, $\angle ABC = 65^o$, $\angle CDE = 15^o$ and $AB = AE$. What is the value of $\angle AEF$ (in degrees)?



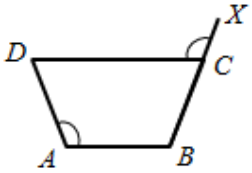
11. In the figure given below, ABC is a triangle. BC is parallel to AE. If $BC = AC$, then what is the value of $\angle CAE$ (in degrees)?



12. In the given figure below, EC is parallel to AB, $\angle ECD = 70^o$ and $\angle BDO = 20^o$. What is the value of $\angle OBD$ (in degrees)?



13. In the quadrilateral $ABCD$, shown below, $\angle DAB = \angle DCX = 120^o$. If $\angle ABC = 105^o$, what is the value of $\angle ADC$ (in degrees)?



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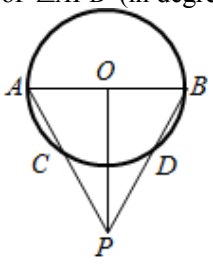
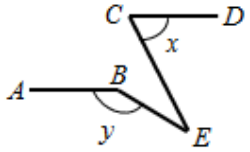
14. In the figure given below $AO = CD$, where O is the centre of the circle. What is the value of $\angle APB$ (in degrees)?



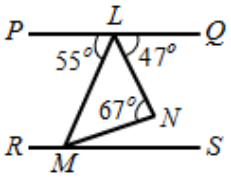
15. In the figure given below, AB is parallel to CD. If $\angle DCE = x$ and $\angle ABE = y$, then what is $\angle CEB$ (in degrees)?



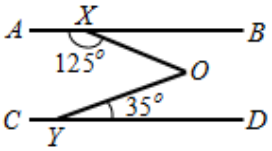
(a) $y - x$ (b) $(x + y)/2$

(c) $x + y - \pi/2$ (d) $x + y - \pi$

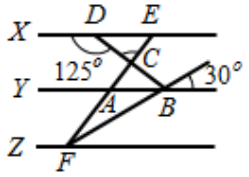
16. In the figure given below, PQ is parallel to RS. What is $\angle NMS$ (in degrees)?



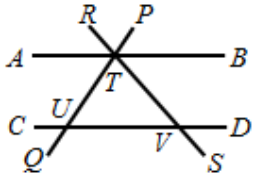
17. In the figure given below, AB is parallel to CD. What is the value of $\angle XOY$ (in degrees)?



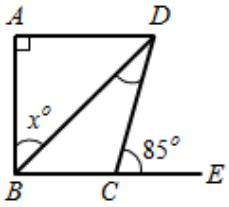
18. Three straight lines X, Y and Z are parallel. $\angle DCE = 80^o$, and two other angles are as shown in the figure below. What is the $\angle AFB$ (in degrees)?



19. In the given figure, if AB is parallel to CD, $\angle PTB = 55^o$ and $\angle DVS = 45^o$, then what is the sum (in degrees) of the measures of $\angle CUQ$ and $\angle RTP$?



20. If $AD \parallel BE$, $\angle DCE = 85^o$, $\angle BDC = 30^o$, then what is the value of x?



21. If triangles ABC and DEF are similar such that $2AB = DE$ and $BC = 8$ cm, then the length (in cm) of EF is _____.

22. In ΔABC, AD is perpendicular to BC and BE is perpendicular to AC. Which of the following is correct?

(a) $CE \times BC = CA \times CD$

(b) $CE \times CA = CD \times CB$

(c) $AD \times BD = AE \times BE$

(d) $AB \times AC = AD \times BE$

23. If AD is the internal angular bisector of ΔABC with $AB = 3$ cm and AC, then what is $BD : BC$ equal to?

(a) 1 : 3 (b) 1 : 4

(c) 2 : 3 (d) 3 : 4

24. AB is a straight line, C and D are points on the same side of AB such that AC is perpendicular to AB and DB is perpendicular to AB. Let AD and BC meet at E. What is $\frac{AE}{AD} + \frac{BE}{BC} =$ _____ units.

(a) 1 (b) 2

(c) 3 (d) Data insufficient

25. E is the mid-point of the median AD of a ΔABC. If BE produced meets the side AC at F, then CF is equal to

(a) $AC/3$ (b) $AC/2$

(c) $AC/4$ (d) $(2/3)AC$

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26. PQR is an equilateral triangle. O is the point of intersection of altitudes PL, QM and RN. If $OP = 8$ cm, what is the perimeter of the ΔPQR?

(a) $8\sqrt{3}$ cm (b) $12\sqrt{3}$ cm
(c) $16\sqrt{3}$ cm (d) $24\sqrt{3}$ cm

27. In ΔABC, $\angle B = 90^o$ and $\angle C = 2\angle A$, then $AB^2 =$

(a) $2BC^2$ (b) $3BC^2$
(c) $4BC^2$ (d) $5BC^2$

28. ABC is a right angled triangle at A and a perpendicular AD is drawn on the hypotenuse BC. What is $BC \times AD$?

(a) $AB \times AC$ (b) $AB \times AD$
(c) $CA \times CD$ (d) $AD \times DB$

29. ABC and XYZ are two similar triangles with $\angle C = \angle Z$, whose areas are respectively 32 cm^2 and 60.5 cm^2. If $XY = 7.7$ cm, then the length (in cm) of AB is _____

30. The diameter of a circle with centre at C is 50 cm. CP is a radial segment of the circle. AB is a chord perpendicular to CP and passes through P. CP produced intersects the circle at D. If $DP = 18$ cm, then what is the length (in cm) of AB?

_____

31. The side BC of a ΔABC is produced to D, bisectors of the $\angle ABC$ and $\angle ACD$ meet at P. If $\angle BPC = x^o$ and $\angle BAC = y^o$, then which one of the following option is correct?

(a) $x^o = y^o$ (b) $x^o + y^o = 90^o$
(c) $x^o + y^o = 180^o$ (d) $2x^o = y^o$

32. Let ABC be an equilateral triangle. If the side BC is produced to the point D so that $BC = 2CD$, then AD^2 is equal to

(a) $3CD^2$ (b) $4CD^2$
(c) $7CD^2$ (d) $5CD^2$

33. ABC is a triangle, where $BC = 2AB$, $\angle C = 30^o$ and $\angle A = 90^o$. The magnitude of the side AC is

(a) $(2/3)BC$ (b) $(3/4)BC$
(c) $(1/\sqrt{3})BC$ (d) $(\sqrt{3}/2)BC$

34. The bisector of BI and CI of the $\angle B$ and $\angle C$ of a ΔABC meet in I. What is $\angle BIC$ equal to?

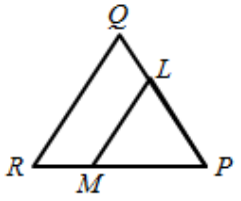
(a) $90^o + \frac{A}{2}$ (b) $90^o + \frac{A}{4}$
(c) $90^o - \frac{A}{2}$ (d) $90^o - \frac{A}{4}$

35. In a ΔABC, $\angle BCA = 90^o$ and CD is perpendicular to AB. If $AD = 4$ cm and $BD = 9$ cm, then the value of DC (in cm) will be _____.

36. The medians of ΔABC intersect at G. Which one of the following is correct?

(a) Five times the area of ΔAGB is equal to four times the area of ΔABC
(b) Four times the area of ΔAGB is equal to three times the area of ΔABC
(c) Three times the area of ΔAGB is equal to the area of ΔABC
(d) None of these

37. In the figure below, LM is parallel to QR. If LM divides the ΔPQR such that area of trapezium $LMRQ$ is two times the area of ΔPLM, then what is the ratio of $PL : LQ$?



(a) $1:\sqrt{2}$ (b) $1:\sqrt{3}$
(c) $1:2$ (d) $1:3$

38. Let D, E be the points on sides AB and AC, respectively of a ΔABC such that DE is parallel to BC. Let $AD = 2$ cm, $DB = 1$ cm, $AE = 3$ cm and area of $\Delta ADE = 3$ cm^2. What is the length (in cm) of EC? _____

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39. ABC is a triangle right angled at B and D is a point on BC produced ($BD > BC$), such that $BD = 2DC$. Which one of the following is correct?

(a) $AC^2 = AD^2 - 3CD^2$

(b) $AC^2 = AD^2 - 2CD^2$

(c) $AC^2 = AD^2 - 4CD^2$

(d) $AC^2 = AD^2 - 5CD^2$

40. PQR is a triangle right angled at Q. If X and Y are the mid-points of the sides PQ and QR, respectively, then which one of the following is not correct?

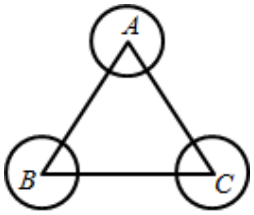
(a) $RX^2 + PY^2 = 5XY^2$

(b) $RX^2 + PY^2 = XY^2 + PR^2$

(c) $RX^2 + PY^2 = 3(PQ^2 + QR^2)$

(d) $4(RX^2 + PY^2) = 5PR^2$

41. In the figure given below, what is the sum of the angles (in degrees) formed around A, B, C except the angles of the ΔABC?



42. In the given figure, ABC is an equilateral triangle of side length 30 cm. XY is parallel to BC, XP is parallel to AC and YQ is parallel to AB. If $XY + XP + XQ = 40$ cm, then the length (in cm) of PQ is _____ cm.

43. In the ΔABC, $AB = 2$ cm, $BC = 3$ cm and $AC = 4$ cm. D is the middle point of AC. If a square is constructed on the side BD, what is the area (in cm^2) of the square? _____.

44. ABC is a triangle. X is a point outside the ΔABC such that $CD = CX$, where D is the point of intersection of BC and AX and $\angle BAX = \angle XAC$. Which one of the following is correct?

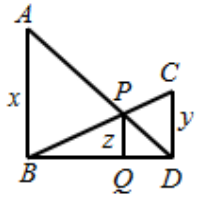
(a) ΔABD and ΔACX are similar

(b) $\angle ABD < \angle ACX$

(c) $AC = CX$

(d) $\angle ADB > \angle DXC$

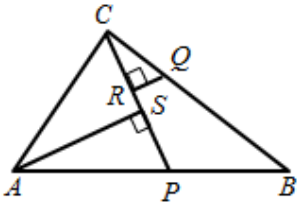
45. In the figure given below, $\angle ABD = \angle PQD = \angle CDQ = \pi/2$. If $AB = x$, $PQ = z$ and $CD = y$, then which one of the following is correct?



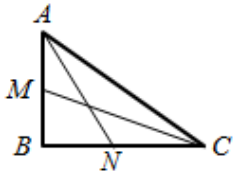
(a) $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$ (b) $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$

(c) $\frac{1}{z} + \frac{1}{y} = \frac{1}{x}$ (d) $\frac{1}{x} + \frac{1}{y} = \frac{2}{z}$

46. In the figure given below, P is a point on AB and PQ is parallel to AC. What is the number of pairs of distinct similar triangles in the figure? _____



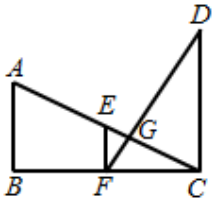
47. If ABC is a triangle, right angled at B and M, N are mid-points of AB and BC, respectively, then what is $4(AN^2 + CM^2)$ equal to?



(a) $3AC^2$ (b) $4AC^2$

(c) $5AC^2$ (d) $6AC^2$

48. AB, EF and CD are parallel lines. If $EG = 5$ cm, $GC = 10$ cm and $DC = 18$ cm, then what is the value of length (in cm) of AC?



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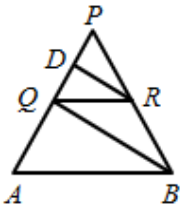
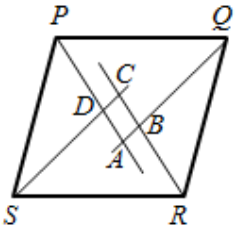
49. In the figure below, QR is parallel to AB and DR is parallel to QB. What is the number of distinct pairs of similar triangles?



50. In ΔABC and ΔDEF, it is given that $AB = 5$ cm, $BC = 4$ cm and $CA = 42$ cm, $DE = 10$ cm, $EF = 8$ cm and $FD = 8.4$ cm. If AL is perpendicular to BC and DM is perpendicular to EF, then what is the ratio of AL to DM?

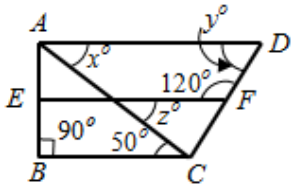
(a) 1 : 2 (b) 2 : 1
(c) 1 : 3 (d) 3 : 1

51. In the figure given below, $PQRS$ is a parallelogram. If AP, AQ, CR and CS are bisectors of $\angle P$, $\angle Q$, $\angle R$ and $\angle S$, respectively, then $ABCD$ is a



(a) square (b) rhombus
(c) rectangle (d) none of these

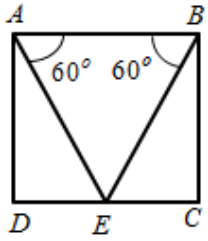
52. In the figure given below, $ABCD$ is a trapezium. EF is parallel to AD and BC. $\angle y$ (in degrees) is _____.



53. $ABCD$ is a parallelogram. If the bisectors of the $\angle A$ and $\angle C$ meet the diagonal BD at points P and Q, respectively, then which one of the following is correct?

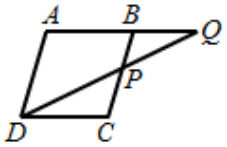
(a) $PCQA$ is a straight line
(b) ΔAPQ is similar to ΔPCQ
(c) $AP = CP$
(d) $AP = AQ$

54. In the figure given below, $ABCD$ is a quadrilateral with AB parallel to DC and AD parallel to BC, ADC is a right angle. If the perimeter of the ΔABE is 6 units, what is the area of the quadrilateral?



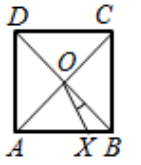
(a) $2\sqrt{3}$ sq. unit (b) 4 sq. unit
(c) 3 sq. unit (d) $4\sqrt{3}$ sq. unit

55. In the figure given below, $ABCD$ is a parallelogram, P is a point in BC such that $PB : PC = 1 : 2$. DP produced meets AB produced at Q. If the area of the ΔBPQ is 20 sq. units, what is the area (in sq. units) of the ΔDCP?



56. ABC is a triangle in which $AB = AC$. Let BC be produced to D. From a point E on the line AC let EF be a straight line such that EF is parallel to AB. Consider the quadrilateral $ECDF$ thus formed. If $\angle ABC = 65^o$ and $\angle EFD = 80^o$, then what is $\angle D$ (in degrees)? _____

57. In the figure given below, $ABCD$ is a square in which $AO = AX$. What is $\angle XOB$ (in degrees)? _____



58. In the figure given below, M is the mid-point of the side CD of the parallelogram $ABCD$. What is $ON : OB$?

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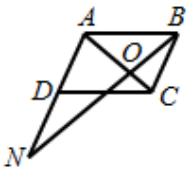
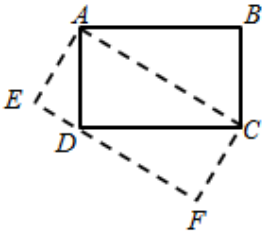


(a) 3 : 2 (b) 2 : 1
(c) 3 : 1 (d) 5 : 2

59. $ABCD$ is a rectangle of dimensions 8 units and 6 units. $AEFC$ is a rectangle drawn in such a way that diagonal AC of the first rectangle is one side and side opposite to it is touching the first rectangle at D as shown in the figure given below. What is the ratio of the area of rectangle $ABCD$ to that of $AEFC$?



(a) 1 : 1 (b) 2 : 1 (c) 1 : 2 (d) 2 : 3

60. $ABCD$ is a square. The diagonals AC and BD meet at O. Let K, L be the points on AB such that $AO = AK$ and $BO = BL$. If $\theta = \angle LOK$, then what is the value of $\tan\theta$? _____.

61. An obtuse angle made by a side of a parallelogram $PQRS$ with other pair of parallel sides is 150^o. If the perpendicular distance between these parallel sides (PQ and SR) is 20 cm, what is the length (in cm) of the side RQ ? _____

62. In a ΔABC, $AB = BC = CA$. The ratio of the radius of the circum-circle to that of the in-circle is
(a) 2 : 1 (b) 3 : 1 (c) 3 : 2 (d) 2 : 3

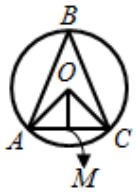
63. The diameter of a circle with centre at C is 50 cm. CP is a radial segment of the circle. AB is a chord perpendicular to CP and passes through P. CP produced intersects the circle at D. If $DP = 18$ cm, then the length (in cm) of AB is _____.

64. A regular hexagon is inscribed in a circle of radius 5 cm. Find the area (in cm^2) of the portion which is inside the circle but outside the hexagon. _____

65. A circular ring with centre O is kept in the vertical position by two weightless thin strings TP and TQ attached to the ring at P and Q. The line OT meets the ring at E whereas a tangential string at E meets TP and TQ at A and B, respectively. If the radius of the ring is 5 cm and $OT = 13$ cm, then the length (in cm) of AB is _____.

66. What is the length of the perpendicular drawn from the centre of circle of radius r on the chord of length $\sqrt{3}r$?
(a) r (b) $\sqrt{2}r$ (c) $r/2$ (d) $r/4$

67. In the figure given below, O is the centre of the circle, if $OA = 3$ cm, $AC = 3$ cm and OM is perpendicular to AC, then $\angle ABC$ (in degrees) is _____.



68. AC is the diameter of the circum-circle of the cyclic quadrilateral $ABCD$. If $\angle BDC = 42^o$, then $\angle ACB$ (in degrees) is _____.

69. Two circles touch each other internally. Their radii are 4 cm and 6 cm. What is the length of the longest chord of the outer circle which is outside the inner circle?
(a) $4\sqrt{2}$ cm (b) $4\sqrt{3}$ cm
(c) $6\sqrt{3}$ cm (d) $8\sqrt{2}$ cm

70. ABC is an equilateral triangle inscribed in a circle with $AB = 5$ cm. Let the bisector of the angle A meet BC in X and the circle in Y. What is the value of $AX \cdot AY$ (in cm^2)? _____

71. Two unequal circles are touching each other externally at P. APB and CPD are two secants cutting the circles at A, B, C and D. Which one of the following is correct?

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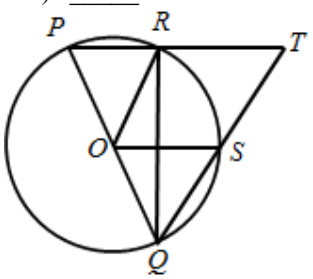
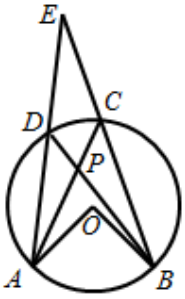
(a) $ABCD$ is a parallelogram
(b) $ABCD$ is a trapezium
(c) $ABCD$ is a rhombus
(d) $ABCD$ is a quadrilateral

72. In the figure given below, if $\angle BAD = 60^o$, $\angle ADC = 105^o$, then $\angle DPC$ (in degrees) is _____.

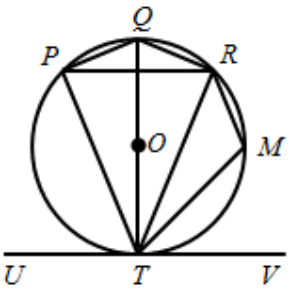
73. In the figure given below, PQ is a diameter of the circle whose centre is at O. If $\angle ROS = 44^o$ and OR is a bisector of $\angle PQR$, then what is the value of $\angle RTS$ (in degrees)? _____



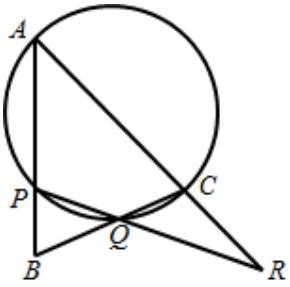
74. In the figure given below, O is the centre of the circle. AC and BD intersect at P. If $\angle AOB = 100^o$ and $\angle DAP = 30^o$, then $\angle APB$ (in degrees) is _____.



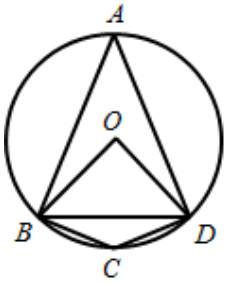
75. In the figure given below, O is the centre of the circle. The line UTV is a tangent to the circle at T, $\angle VTR = 52^o$ and ΔPTR is an isosceles triangle such that $TP = TR$. Find $\angle RPT + \angle PTO + \angle PMR$ (in degrees). _____



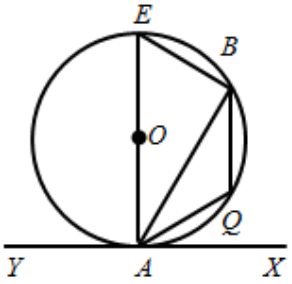
76. In the figure given below, what is $\angle CBA$ (in degrees), if $\angle QCA = 75^o$. _____



77. A, B, C, D are four distinct points on a circle whose centre is at O. $\angle OBD - \angle CDB = \angle CBD - \angle ODB$, then $\angle A$ (in degrees) is _____.

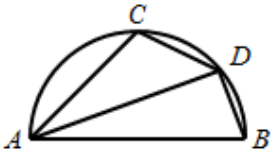


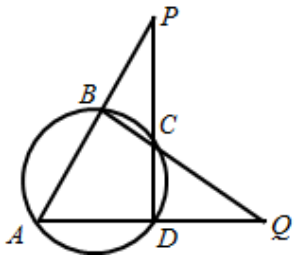
78. In the figure given below, YAX is a tangent to the circle with centre O. If $\angle BAX = 70^o$ and $\angle BAQ = 40^o$, then what $\angle ABQ$ (in degrees) is _____.



79. In the figure given below, C and D are points in the semi-circle described on AB as diameter. If $\angle ABD = 75^o$ and

$\angle DAC = 35^o$, then $\angle BDC$ (in degrees) is _____.





80. In the figure given below, if $\angle PAQ = 59^o$, $\angle APD = 40^o$, then $\angle AQB$ (in degrees) is _____.

10.2 Lines and Planes

The theory for lines and planes is already covered in chapter '0' of engineering mathematics section. Let us consider some examples.

Example [GA-2012 (2 marks)]: Two points $(4, p)$ and $(0, q)$ lie on a straight line having a slope of $3/4$. The value of $(p-q)$ is

(a) –3 (b) 0 (c) 3 (d) 4

Solution (c): $(q-p)/(0-4) = 3/4 \Rightarrow p-q = 3$.

Example [GA-2014 (2 marks)]: When a point inside of a tetrahedron (a solid with four triangular surfaces) is connected by straight lines to its corners, how many (new) internal planes are created with these lines? _____.

Solution: We know that a plane is formed by 3 points in a space. So earlier there are four points in space so total number of planes will be ${}^4C_3 = 4$. Now after connecting the corner points with another point in space, we have total 5 points in space and from these, the total number of planes will be ${}^5C_3 = 5!/\{(3!)(2!)\} = 10$. Thus the required new planes will be $10-4 = 6$.

Example [GA-2016 (2 marks)]: A straight line is fit to a data set $(\ln x, y)$. This line intercept the abscissa at $\ln x = 0.1$ and has a slope of –0.02. What is the value of y at $x = 5$ from the fit?

(a) –0.030 (b) –0.014 (c) 0.014 (d) 0.030

Solution (a): In the data set (x, y), the equation of straight line is $y = mx + c$, where m is the slope and c is the $y-$intercept.

So in the data set $(\ln x, y)$, the equation of straight line is $y = m(\ln x) + c$ …(i), where m is the slope and c is the $y-$intercept.

It is given that $m = -0.02$, and at $y = 0$, $\ln x = 0.1$. So substituting all these in (i), we get $0 = (-0.02)(0.1) + c \Rightarrow c = 0.002$.

So the equation of straight line in the data set $(\ln x, y)$ is $y = (-0.02)(\ln x) + 0.002$ …(ii)

Now we have to find the value of y at $x = 5$; so from (ii), we have $y = (-0.02)(\ln 5) + 0.002 = -0.030$. Hence option (a) is correct.

Please note that the exercise on line and planes is already given in 'Section 0.5 of Engineering Mathematics' as it is a common topic on Engineering Mathematics and General Aptitude.

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Answer Keys

Answer Keys: Exercise 10.1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
a	0.5	0.64	118.4	6	c	33	b	9	32	2000	100	38	125	154
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
c	120	600	8	c	3	12	d	4.5	d	b	4	d	d	b
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
6	c	12	84	c	a	21.5	d	25	c	c	59	b	a	a
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
b	114	0.17	d	b	a	1.5	d	d	b	375.86	18.33	c	a	a
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
72	b	d	12	4400	14	352	c	24	d	d	a	b	100	c
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
9	19.4	d	b	a	23.45	30	b	b	10	c	d	12	13	d
91	**92**	**93**	**94**	**95**	**96**	**97**								
20	22	1.9	b	0	35.68	364								

Answer Keys: Exercise: 10.2

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
b	4.5	b	53	80	50	28	a	c	35	50	110	75	60	a
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
20	90	15	135	35	16	c	d	d	d	d	b	a	5.6	48
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
d	c	d	a	6	c	b	1.5	a	c	900	10	2.5	a	a
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
2	c	25	3	a	c	60	b	a	80	35	22.5	b	a	1
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
40	a	48	13.62	6.67	c	30	48	a	25	d	45	68	80	218
76	**77**	**78**	**79**	**80**										
60	60	30	130	22										

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Chapter 11 : Permutation & Combination and Probability & Statistics

11.1 Permutation and Combination

The theory on permutation and combinations is already covered in chapter 6 of Engineering Mathematics. Let us consider some example:

Example [GA-2010 (2 marks)]: Given digits 2, 2, 3, 3, 3, 4, 4, 4, 4 how many distinct 4 digit numbers greater than 3000 can be formed?
(a) 50 (b) 51 (c) 52 (d) 54
Solution (b): Step 1: First digit is 3: Then the rest of the numbers must come from the list: 2, 2, 3, 3, 4, 4, 4, 4. Therefore we may choose any 3-digit sequence except 222 and 333 for the rest of the digits. This shows there are $3\times3\times3-2=25$ numbers in this case. **Step-2 First digit is 4:** Then the rest of the numbers must come from the list 2, 2, 3, 3, 3, 4, 4, 4 Therefore we may choose any 3-digit sequence except 222 for the rest of the digits. This shows there are $3\times3\times3-1=26$ numbers in this case. So total number is $25+26=51$.

Example [GA-2010 (2 marks)]: Consider the set of integers $\{1,2,3,\cdots,5000\}$. The number of integers that is divisible by neither 3 nor 4 to:
(a) 1668 (b) 2084 (c) 2500 (d) 2916
Solution (c): If $\lfloor x \rfloor$ is the greatest integer $\le x$; then number of integers from 1 to 5000 that are divisible by 3 is $\lfloor 5000/3 \rfloor = \lfloor 1666.66 \rfloor = 1666$; similarly, number of integers from 1 to 5000 that are divisible by 4 is $\lfloor 5000/4 \rfloor = \lfloor 1250 \rfloor = 1250$. We have double count some integers which are divisible by both 3 and 4; so we take $\text{LCM}(3,4)=12$; thus number of integers from 1 to 5000 that are divisible by 12 is $\lfloor 5000/12 \rfloor = \lfloor 416.66 \rfloor = 416$. So total number of integers which are divisible by 3 or 4 is $1666+1250-416=2500$. So, number of integers divisible by neither 3 nor 4 is $5000-2500=2500$.

Example [GA-2011 (1 mark)]: In how many ways 3 scholarships can be awarded to 4 applicants, when each applicant can receive any number of scholarships?
(a) 4 (b) 12 (c) 64 (d) 81
Solution (c): As each applicant can receive any number of scholarships so 1st scholarship can be given to 4 applicants; similarly 2nd and 3rd scholarship can be given to 4 applicants. Thus total number of ways in which 3 scholarships can be awarded to 4 applicants is $4\times4\times4=64$.

Example [GA-2014 (2 marks)]: A five digit number is formed using the digits 1,3,5,7 and 9 without repeating any of them. What is the sum of all such possible five digit numbers?
(a) 6666660 (b) 6666600 (c) 6666666 (d) 6666606
Solution (b): The possible five digit numbers formed is $5\times4\times3\times2\times1=120$ ways. The number of times each digit exist in a column is $120/5=24\times$ (each digit in a column). As each column total is $24\times(1+3+5+7+9)=600$. This gives the sum total given in the table.

Carry: 66	Carry: 66	Carry: 66	Carry: 60	
600	600	600	600	600
666	6	6	0	0
So the sum is 6666600				

Example [GA-2012 (1 mark)]: Ten teams participate in a tournament. Every team plays each of the other teams twice. The total number of matches to be played is
(a) 20 (b) 45 (c) 60 (d) 90
Solution (d): Here there is no order of the matches, so we have to compute the number of matches once each, then we doubles it. The number of combinations of the ten teams taken two at a time is ${}^{10}C_2 = 10!/(2!8!) = 45$. So there are 45 matches possible on the first round.

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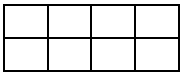
Therefore, there are 90 matches for a double round.

Example [GA-2015 (1 mark)]: Five teams have to compete in a league, with every team playing every other team exactly once, before going to the next round. How many matches will have to be held to complete the league round of matches?
(a) 20 (b) 10 (c) 8 (d) 5
Solution (b): As two teams are needed for a match to be played. So, total number of matches is equal to the number of selecting 2 out of 5 teams, i.e. ${}^5C_2 = 10$.

Example [GA-2015 (2 marks)]: How many four digit numbers can be formed with the 10 digits $0,1,2,\cdots,9$ if no number can start with 0 and if repetitions are not allowed? _____
Solution: In thousands place, 9 digits (except 0) can be placed in 9 ways. In hundreds place, 9 digits can be placed (including 0, excluding the one used in thousands place) in 9 ways. In tens place, 8 digits can be placed (excluding the ones used in thousands and hundreds place), in 8 ways. In ones place, 7 digits can be placed (excluding the one used in thousands, hundreds and tens place) in 7 ways. Thus total number of combinations is $9\times9\times8\times7 = 4536$.

Example [GA-2015 (2 marks)]: Right triangle PQR is to be constructed in the $xy-$plane so that the right angle is at P and line PR is parallel to the $x-$axis. The x and y coordinates of P, Q and R are to be integers that satisfy the inequalities: $-4 \le x \le 5$ and $6 \le y \le 16$. How many different triangles could be constructed with these properties?
(a) 110 (b) 1100 (c) 9900 (d) 10000
Solution (c): We need to determine how many ways we can combine P, Q and R to form a triangle. For each point, we need to choose an x value and a y value.
Point P: x value: $-4 \le x \le 5$, giving us 10 choices; y value: $6 \le y \le 16$, giving us 11 choices. Now we have to combine the number of choices for x with the number of choices for y. Thus for point P, the total number of choices is (number of choices for x)$\times$(number of choices for y)$=10\times11=110$.
Point Q: In order to construct a right triangle, Q has to have the same x coordinate as P (so that Q is directly above P and we get a right angle). So we have only 1 choice for x, it must be the same integer that we chose for P's x value. If P and Q have the same x value, they can't have the same y value, or they will be the same point. We used 1 of our 11 choices for y when we chose P, so we have $11-1=10$ choices for Q's y value. Thus for point Q, the total number of choices is (number of choices for x)$\times$(number of choices for y)$=1\times10=10$ choices for Q.
Point R: For PR to be parallel to the x axis, P and R have to share the same y value. So the number of choices for y is 1; it must be the same integer that we chose for P's y value. If P and R have the same y value, they can't have the same x value, or they will be the same point. We used 1 of our 10 choices for x when we chose P, so we have $10-1=9$ choices for R's x value. Thus for point R, the total number of choices is (number of choices for x)$\times$(number of choices for y)$=9\times1=9$ choices for R. Thus we have 110 choices for P, 10 choices for Q, and 9 choices for R, and number of ways to combine P, Q and R to make a triangle is (number of choices for P)$\times$(number of choices for Q)$\times$(number of choices for R)$=110\times10\times9=9900$.

Example [GA-2016 (2 marks)]: In a 2×4 rectangle grid shown below, each cell is a rectangle. How many rectangles can be observed in the grid?



(a) 21 (b) 27 (c) 30 (d) 36
Solution (c): We know that in a rectangle of $n\times p$ $(n<p)$, number of rectangles of any size is $(np/4)(n+1)(p+1)$. In the given question, we have $n=2$, $p=4$, thus total number of rectangles in the given grid is $(2\times4/4)(2+1)(4+1)=2\times3\times5=30$. So option (c) is correct.

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Example [GA-2016 (2 marks)]: The numeral in the units position of $211^{870}+146^{127}\times 3^{424}$ is _____.
Solution: The unit digit in 211^{870} is 1; the unit digit in 146^{127} is 6; the unit digit in 3^{424} is 1. So the numeral in the units position of $211^{870}+146^{127}\times 3^{424}$ is the numeral in the units position of $1+6\times 1=7$.

Please note that the exercise on 'Permutation and Combination' is already given in chapter 6 of 'Engineering Mathematics' as it is a common topic on Engineering Mathematics and General Aptitude.

11.2 Probability and Statistics

The theory on probability and statistics is already covered in chapter 6 of engineering mathematics. Let us consider some example:

Example [GA-2012 (2 marks)]: Which of the following assertions are CORRECT?
P: Adding 7 to each entry in a list adds 7 to the mean of the list
Q: Adding 7 to each entry in a list adds 7 to the standard deviation of the list
R: Doubling each entry in a list doubles the mean of the list
S: Doubling each entry in a list leaves the standard deviation of the list unchanged
(a) P, Q (b) Q, R (c) P, R (d) R, S
Solution (c): We know that adding a constant 'k' to each data will change the mean by 'k', but there is no change in variance. We also know that doubling each entry in a list doubles both the mean and standard deviation of the list. So assertions 'P' and 'R' are correct.

Example [GA-2012 (2 marks)]: Two policemen, A and B, fire once each at the same time at an escaping convict. The probability that A hits the convict is three times the probability that B hits the convict. If the probability of the convict not getting injured is 0.5, the probability that B hits the convict is
(a) 0.14 (b) 0.22 (c) 0.33 (d) 0.40
Solution (a): $P(A)=3P(B)$. Let $P(C)$ be the probability of a convict getting injured, so $P(C)=1-0.5=0.5$. Now the convict gets injured by B if either it was hit by only B or by both A and B. Let $P(B)=x$ so the probability that the convict was injured by B is $P(B)=x$ and the probability that it was injured by both A and B is $P(A)\times P(B)=3x^2$. So we have $\Rightarrow 0.5=3x+3x^2 \Rightarrow 3x^2+3x-0.5=0 \Rightarrow x=0.1455$.

Example [GA-2012 (2 marks)]: A smuggler has 10 capsules in which five are filled with narcotic drugs and the rest contain the original medicine. All the 10 capsules are mixed in a single box, from which the customs officials picked two capsules at random and tested for the presence of narcotic drugs. The probability that the smuggler will be caught is
(a) 0.50 (b) 0.67 (c) 0.78 (d) 0.82
Solution: The total number of ways for 2 from 10 capsules are picked is ${}^{10}C_2=10!/(2!8!)=45$ ways. The smuggler will be caught if at least one from two picked capsules contains narcotic drug; so the official must pick (i) 1 from 5 narcotic drug containing capsule and 1 from 5 medicine containing capsule, or (ii) both for 2 from 5 narcotic drug containing capsules. The number of ways in which (i) can occur is ${}^5C_1\times{}^5C_1=5\times 5=25$ ways; (ii) can occur in ${}^5C_2=5!/(2!3!)=10$ ways. Thus the total number of ways on which a smuggler is caught is $25+10=35$ ways. So the probability that the smuggler will be caught is $35/45=0.78$.

Example [GA-2012 (2 marks)]: A and B are friends. They decide to meet between 1 PM and 2 PM on a given day. There is a condition that whoever arrives first will not wait for the other for more than 15 minutes. The probability that they will meet on that day is
(a) 1/4 (b) 1/16 (c) 7/16 (d) 9/16

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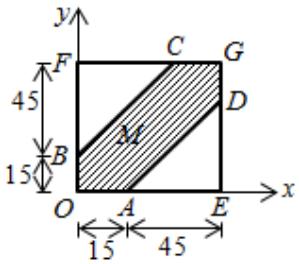
Solution (c): Let us use as sample space the unit square, as shown in figure. Let X and Y be the two independent, randomly chosen times by person X and Y respectively from the one hour period. These assumptions imply that every point in the unit square is equally likely, where the first coordinate represents the time when person X shows up and the second coordinate represents when person Y shows up. As 15 minutes is quarter of the time between 1 pm and 2 pm, the required probability in this situation is the area of the shaded region – the set of all points satisfying $|X-Y| = 1/4$, which is represented by the shaded region. Total sample space will be area of *OEGFO* which is $60 \times 60 = 3600 \min^2$; and our favourable case is area of the shaded region which is (area of *OEGFO* – twice of area of *AEDA*); thus our favourable case is $60 \times 60 - 2 \times (1/2) \times 45 \times 45 = 1575$. Thus the required probability is $1575/3600 = 7/16$.



Example [GA-2012 (2 marks)]: An automobile plant contracted to buy shock absorbers from two suppliers X and Y. X supplies 60% and Y supplies 40% of the shock absorbers. All shock absorbers are subjected to a quality test. The ones that pass the quality test are considered reliable. Of X's shock absorbers, 96% are reliable. Of Y's shock absorbers, 72% are reliable. The probability that a randomly chosen shock absorber, which is found to be reliable, is made by Y is

(a) 0.288 (b) 0.334 (c) 0.667 (d) 0.720

Solution (b): The percentage of shock absorbers from the two suppliers that are actual reliable is given in the table. So the probability that a randomly chosen reliable shock absorber made by Y is $P(Y) = 28.8/(57.6 + 28.8) = 0.334$.

Task	X	Y
Supply	60%	40%
Reliable	96%	72%
Actual	57.6%	28.8%

Example [GA-2013 (2 marks)]: In a factory, two machines M1 and M2 manufacture 60% and 40% of the auto components respectively. Out of the total production, 2% of M1 and 3% of M2 are found to be defective. If a randomly drawn auto component from the combined lot is found defective, what is the probability that it was manufactured by M2?

(a) 0.35 (b) 0.45 (c) 0.50 (d) 0.40

Solution (c): The percentage of auto components from the two machines that are actual defective is given in the table. So the probability that a randomly chosen defective auto component manufactured by M2 is $P(Y) = 12\%/(12\% + 12\%) = 0.5$.

Task	M1	M2
Auto components	60%	40%
Defective	2%	3%
Actual defective	12%	12%

Example [GA-2013 (2 marks)]: What is the chance that a leap year, selected at random, will contain 53 Saturdays?

(a) $2/7$ (b) $3/7$ (c) $1/7$ (d) $5/7$

Solution (a): A leap year has 366 days, therefore 52 weeks i.e. 52 Sunday and 2 days. The remaining 2 days may be any of the following: (i) Sunday and Monday; (ii) Monday and Tuesday; (iii) Tuesday and Wednesday; (iv) Wednesday and Thursday; (v) Thursday and Friday; (vi) Friday and Saturday; (vii) Saturday and Sunday. For having 53 Sundays in a year, one of the remaining 2 days must be a Sunday. So $n(S) = 7$ and $n(E) = 2$ and thus $P(E) = n(E)/n(S) = 2/7$.

Example [GA-2013 (2 marks)]: Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7?

(a) $13/90$ (b) $12/90$ (c) $78/90$ (d) $77/90$

Solution (d): Total number of two digit number between 1 and 100 is 90 (excluding 1 to 9 and 100 from 1 to 100). Total number between 1 to 100 that are divisible by 7 is $[100/7] = [14.28] = 14$,

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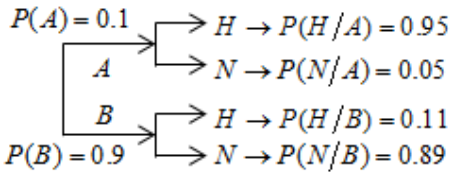
where $[x]$ is the greatest integer less than or equal to x. Among these 14 numbers we have to exclude 7, which is a one digit number; so total number of two digit numbers between 1 and 100 that are divisible by 7 is $14-1=13$. Thus the probability that the selected number is divisible by 7 is $13/90$; and hence the probability that the selected number is not divisible by 7 is $1-13/90=77/90$.

Example [GA-2014 (1 mark)]: In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is _____ years.
Solution: In any given year, the probability of an earthquake is 0.04, i.e. $P=0.04=4/100 \Rightarrow$ there can be 4 earthquakes in 100 years. So, 1 earthquake will occur in $100/4=25$ years. Thus the average time between successive occurrences of such earthquakes is 25 years.

Example [GA-2014 (2 marks)]: 10% of the population in a town is HIV^+. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV^+ individuals 95% of the time, and HIV^- individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____.
Solution: Let A, B be the events of a person being HIV^+ and HIV^-, respectively. So $P(A)=10/100=0.1$ and $P(B)=1-P(A)=0.9$. Let H, N be the event when a person is tested with the kit, it shows the person is HIV^+ and HIV^-, respectively. So $P(H/A)=0.95$, $P(N/A)=0.05$, $P(H/B)=0.11$, $P(N/B)=0.89$. The situation is described in the figure. So if a person is selected then the probability that the individual is actually HIV^+ is



$$P(A/H)=\frac{P(A)\times P(H/A)}{P(A)\times P(H/A)+P(B)\times P(H/B)}=\frac{0.1\times 0.95}{0.1\times 0.95+0.9\times 0.11}=0.4896.$$

Example [GA-2014 (2 marks)]: You are given three coins: one has heads on both faces, the second has tails on both faces, and the third has a head on one face and a tail on the other. You choose a coin at random and toss it, and it comes up heads. The probability that the other face is tails is
(a) $1/4$ (b) $1/3$ (c) $1/2$ (d) $2/3$
Solution (b): Let H and N be the events that we saw a head and it is a normal coin, respectively. $H=\{\text{Saw a head}\}$, $N=\{\text{Normal coin}\}$. Now we need to calculate the conditional probability that it is a normal coin given that we saw a head: $P(N/H)=\frac{P(N\cap H)}{P(H)}=\frac{P(N)P(H/N)}{P(H)}=\frac{(1/3)(1/2)}{(1/2)}=\frac{1}{3}$.
In this problem, there is a tendency to reason that since the opposite face is either heads or tails, the desired probability is 1/2. This is, however, wrong, because given that heads came, it is more likely that the two headed coin was chosen.

Example [GA-2014 (1 mark)]: A regular die has six sides with numbers 1 to 6 marked on its sides. If a very large number of throws show the following frequencies of occurrence: $1\rightarrow 0.167$, $2\rightarrow 0.167$, $3\rightarrow 0.152$, $4\rightarrow 0.166$, $5\rightarrow 0.168$, $6\rightarrow 0.180$. We call this die
(a) Irregular (b) Biased (c) Gaussian (d) Insufficient
Solution (b): For a very large number of throws, the frequency should be same for unbiased throw. As it is not same so the die is biased.

Example [GA-2014 (2 marks)]: A batch of one hundred bulbs is inspected by testing four randomly chosen bulbs. The batch is rejected if even one of the bulbs is defective. A batch typically has five defective bulbs. The probability that the current batch is accepted is _____.
Solution: Probability for one bulb to be non-defective is $(100-5)/100=95/100=0.95$. So the probability that none of the four tested bulb is defective is $0.95\times 0.95\times 0.95\times 0.95=0.8145$.

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Example [GA-2015 (1 mark)]: Ram and Ramesh appeared in an interview for two vacancies in the same department. The probability of Ram's selection is $1/6$ and that of Ramesh is $1/8$. What is the probability that only one of them will be selected?

(a) $47/48$ (b) $1/4$ (c) $13/48$ (d) $35/48$

Solution (b): Let p, q be the event of Ram, Ramesh being selected, respectively; r, s be the event of Ram, Ramesh not being selected. So $p=1/6$, $q=1/8$, $r=1-p=5/6$, $s=1-q=7/8$. So required probability that only one will be selected is $ps+qr=(1/6)\times(7/8)+(1/8)\times(5/6)=1/4$.

Example [GA-2015 (2 marks)]: A coin is tossed thrice. Let X be the event that head occurs in each of the first two tosses. Let Y be the event that a tail occurs on the third toss. Let Z be the event that two tails occurs in three tosses. Based on the above information, which one of the following statements is TRUE?

(a) X and Y are not independent (b) Y and Z are dependent
(c) Y and Z are independent (d) X and Z are independent

Solution (b): As a coin is tossed thrice, so we have a sample of $2^3=8$, all with equal probability: $\{HHT,HHH,HTH,HTT,TTT,THT,TTH,THH\}$. As per given data we have: $X=\{HHT,HHH\}$; $Y=\{HHT,HTT,TTT,THT\}$; $Z=\{HTT,THT,TTH\}$. Now $P(X)=2/8=1/4$; $P(Y)=4/8=1/2$, $P(Z)=3/8$. We know that two event A and B are independent if $P(A\cap B)=P(A)\times P(B)$. So

$X\cap Y=\{HHT\}\Rightarrow P(X\cap Y)=1/8=P(X)\times P(Y)\Rightarrow$ X and Y are independent;

$Y\cap Z=\{HTT,THT\}\Rightarrow P(Y\cap Z)=2/8=1/4\neq P(Y)\times P(Z)\Rightarrow$ Y and Z are dependent;

$X\cap Z=\{\phi\}\Rightarrow P(Z\cap Z)=0\neq P(X)\times P(Z)\Rightarrow$ X and Z are dependent.

Example [GA-2015 (1 mark)]: Given Set $A=\{2,3,4,5\}$ and Set $B=\{11,12,13,14,15\}$, two numbers are randomly selected, one from each set. The probability that the sum of the two numbers is 16 is ___

(a) 0.20 (b) 0.25 (c) 0.30 (d) 0.33

Solution (a): Total number of favourable cases is number of ways for which 1 from 4 numbers from set A and 2 from 5 numbers from set B are selected, i.e. $n(S)={}^4C_1\times{}^5C_1=20$. Let E be the event of getting the sum of selected numbers be 16; thus $E=\{(5,11),(4,12),(3,13),(2,14)\}\Rightarrow n(E)=4$. So the required probability is $P(E)=n(E)/n(S)=4/20=0.2$.

Example [GA-2015, IIT-JEE-1999 (2 marks)]: The probability that a student passes in Mathematics, Physics and Chemistry are m, p and c, respectively. Of these subjects, the student has 75% chance of passing in at least one, a 50% chance of passing in at least two and a 40% chance of passing in exactly two. Following relations are drawn in m, p and c:

I. $p+m+c=27/20$; II. $p+m+c=13/20$; III. $(p)\times(m)\times(c)=1/10$.

(a) Only relation I is true (b) Only relation II is true
(c) Relations II and III are true (d) Relations I and III are true

Solution (d): Let A, B and C are the events that the student passes in Mathematics, Physics and Chemistry. From the given data we have $P(A)=m$, $P(B)=p$, $P(C)=c$. As the student has 75% chance of passing in at least one so $0.75=P(\text{at least 1 subject})=P(A\cup B\cup C)$ $\Rightarrow 0.75=1-P(A'\cap B'\cap C')=1-(1-m)(1-p)(1-c)\Rightarrow(1-m)(1-p)(1-c)=0.25$ …(i); Also passing in at least two subject is same as 'passing in two subjects and fail in one subject' or 'passing in all three subject'; thus we have $0.50=P(\text{passing at least two subjects})$ $\Rightarrow 0.50=pm(1-c)+pc(1-m)+cm(1-p)+pcm$ ...(ii); also passing in exactly two subject is same as 'passing in two subjects and fail in one subject', thus we have $0.40=pm(1-c)+pc(1-m)+cm(1-p)$ …(iii). Thus $(ii)-(iii)\Rightarrow 0.1=pmc\Rightarrow$ (III) relation is

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correct. As putting value of $pmc = 0.1$ in (iii), we get $pm + pc + cm = 0.7$ …(iv). As (i) $\Rightarrow 1-(m+p+c)+(pm+pc+cm)-pmc = 0.25$, so putting (iv) and (III) in it we get $1-(m+p+c)+(0.7)-0.1 = 0.25 \Rightarrow m+p+c = 1.35 = 27/20 \Rightarrow$ (I) relation is correct.

Example [GA-2015 (1 mark)]: Four cards are randomly selected from a pack of 52 cards. If the first two cards are kings, what is the probability that the third card is a king?

(a) $4/52$ (b) $2/50$ (c) $(1/52)\times(1/52)$ (d) $(1/52)\times(1/51)\times(1/50)$

Solution (b): As 4 kings are out of 52 cards. If 2 cards (both are kings) are selected, then remaining cards will be 50 out of which, 2 cards are selected. So probability that third card is a king is $2/50$.

Example [GA-2016 (2 marks)]: A person moving through a tuberculosis prone zone has a 50% probability of becoming infected. However, only 30% of infected people develop the disease. What percentage of people moving through a tuberculosis prone zone remains infected but does not show symptoms of disease?

(a) 15 (b) 33 (c) 35 (d) 37

Solution (c): Let 'x' be total number of people. As a person has a 50% probability of becoming infected, so $0.5x$ number of people are infected. As 30% of infected people develop the disease, so 70% of infected people do not develop the disease. Hence $0.5x \times \frac{70}{100} = 0.35x$ number of people who are moving through a tuberculosis prone zone remains infected but does not show symptoms of disease. So the required percentage is $(0.35x/x)\times 100 = 35\%$. Hence option (c) is correct.

Example [GA-2016 (2 marks)]: Students taking an exam are divided into two groups, P and Q such that each group has the same number of students. The performance of each of the students in a test was evaluated out of 200 marks. It was observed that the mean of group P was 105, while that of group Q was 85. The standard deviation of group P was 25, while that of group Q was 5. Assuming that the marks were distributed on a normal distribution, which of the following statements will have the highest probability of being **TRUE**?

(a) No student in group **Q** scored less marks than any student in group **P**.
(b) No student in group **P** scored less marks than any student in group **Q**.
(c) Most students of group **Q** scored marks in a narrower range than students in group **P**.
(d) The median of the marks of group **P** is 100.

Solution (c):

Group P

Mean, $\mu_P = 105$

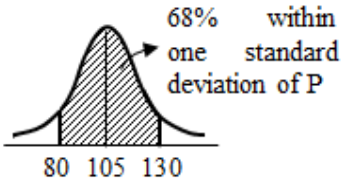
Standard deviation, $\sigma_P = 25$

$\Pr(\mu_P - \sigma_P \le x \le \mu_P + \sigma_P) \simeq 0.68$

As, $\mu_P - \sigma_P = 105 - 25 = 80$, and

$\mu_P + \sigma_P = 105 + 25 = 130$;

Hence 68% with one standard deviation of P range of marks is 80 to 130



Group Q

Mean, $\mu_Q = 85$

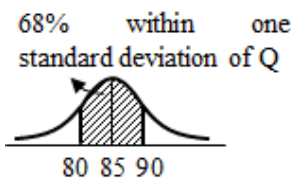
Standard deviation, $\sigma_Q = 5$

$\Pr(\mu_Q - \sigma_Q \le x \le \mu_Q + \sigma_Q) \simeq 0.68$

As, $\mu_Q - \sigma_Q = 85 - 5 = 80$, and

$\mu_Q + \sigma_Q = 85 + 5 = 90$;

Hence 68% with one standard deviation of Q range of marks is 80 to 90



As range of marks of group P is 80 to 130; and range of marks of group Q is 80 to 90 so options (a) and (b) are not correct. From the figure, we can say that most students of group Q scored marks in a narrower range than students in group P. Hence option (c) is correct.

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Example [GA-2016 (2 marks)]: Shaquille O' Neal is a 60% career free throw shooter, meaning that he successfully makes 60 free throws out of 100 attempts on average. What is the probability that he will successfully make exactly 6 free throws in 10 attempts?

(a) 0.2508 (b) 0.2816 (c) 0.2934 (d) 0.6000

Solution (a): The probability of exactly r free throws in 10 attempts is given by the $(r+1)^{th}$ term in the expansion of $(0.4+0.6)^{10}$, which is ${}^{10}C_r(0.4)^{10-r}(0.6)^r$.

Thus the probability of exactly 6 successful throws is ${}^{10}C_6(0.4)^{10-6}(0.6)^6 = {}^{10}C_6(0.4)^4(0.6)^6 = 0.2508$

Please note that the exercise on 'Probability and Statistics' is already given in chapter 6 of 'Engineering Mathematics' as it is a common topic on Engineering Mathematics and General Aptitude.

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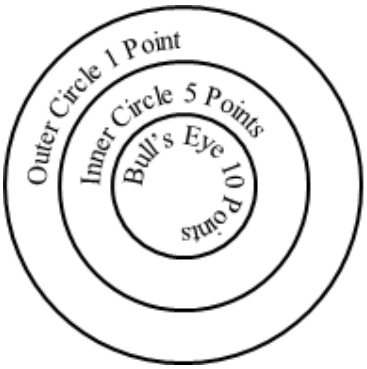
Chapter 12 : Data Interpretation

Data plays an important role in day to day life. If data is too large, it can be represented in precise form in a number of ways. Once data is represented in precise form, the user of that data has to understand it properly. The process of interpreting the data from its precise form is called Data Interpretation. Some of the common ways of representing data is given as:

- Data Tables
- Bar Charts
- Three-variable Graphs
- Pie Charts
- Two-variable Graphs
- Combination of two or more charts or graphs

Let us consider some examples:

Example [GA-2011 (2 marks)]: Four archers P, Q, R and S try to hit a bull's eye during a tournament consisting of seven rounds. As illustrated in the figure below, a player receives 10 points for hitting the bulls' eye, 5 points for hitting within the inner circle and 1 point for hitting within the outer circle. The final scores received by the players during the tournament are listed in the table below:



Round	P	Q	R	S
1	1	5	1	10
2	5	10	10	1
3	1	1	1	5
4	10	10	1	1
5	1	5	5	10
6	10	5	1	1
7	5	10	1	1

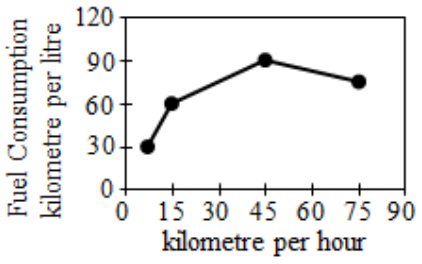
(a) P and S (b) Q and R
(c) Q and Q (d) R and Q

The most accurate and the most convenient players during the tournament are respectively

Solution (b): The most accurate player is the one who scores maximum; the most convenient (which means, involving little trouble or effort) the one who scores minimum. From the given score table, the total scores by P, Q, R, S are 33, 46, 20 and 29 points, respectively. So the most accurate player is Q whose score is 46 points (which is the maximum among all); and the most convenient player is R whose score is 20 points (which is the minimum among all).

Example [GA-2011 (2 marks)]: The fuel consumed by a motorcycle during a journey while traveling at various speeds is indicated in the graph below. The distances covered during four laps of the journey are listed in the table below. From the given data we can conclude that the fuel consumed per kilometre was least during the lap

Lap	Distances (kilometres)	Average Speed (kilometre per hour)
P	15	15
Q	75	45
R	40	75
S	10	10



(a) P (b) Q (c) R (d) S

Solution (a): For lap 'P', which is 15 km in distance, the fuel consumption, when average speed was 15 km/h, was 60 km/litre; so in 1 km, the fuel consumed was $\frac{15\,\text{km}}{60\,\text{km/litre}} = \frac{1}{4}$ litres. Similarly, for lap 'Q', the fuel consumed was $\frac{75\,\text{km}}{90\,\text{km/litre}} = \frac{5}{6}$ litres; for lap 'R', the fuel consumed was

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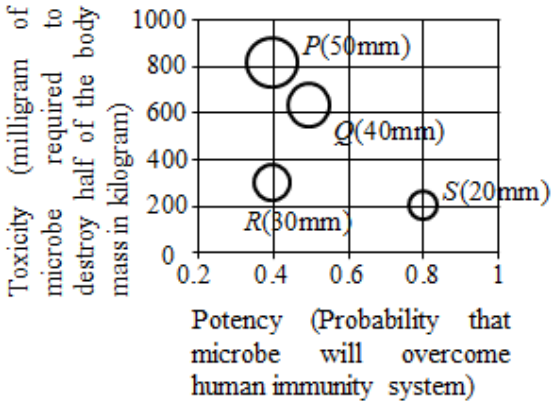
$\frac{40\,\text{km}}{75\,\text{km/litre}} = \frac{8}{15}$ litres; and for lap 'S', the fuel consumed was $\frac{10\,\text{km}}{30\,\text{km/litre}} = \frac{1}{3}$ litres. Hence the fuel consumed per kilometre was least during the lap 'P'.

Example [GA-2011 (2 marks)]: P, Q, R and S are four types of dangerous microbes recently found in a human habitat. The area of each circle with its diameter printed in brackets represents the growth of a single microbe surviving human immunity system within 24 hours of entering the body. The danger to human beings varies proportionately with the toxicity, potency and growth attributed to a microbe shown in the figure below. A pharmaceutical company is contemplating the development of a vaccine against the most dangerous microbe. Which microbe should the company target in its first attempt?

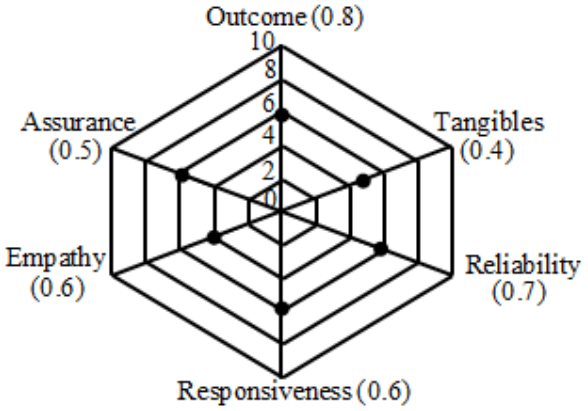


(a) P (b) Q (c) R (d) S

Solution (d): From the given data, for microbe P , we can conclude that 800 milligram of microbe P (whose growth rate is $\pi(50^2)/4 = 625\pi$ mm^2 per 24 hours) is required to destroy half of the body mass in kg; which means $800/625\pi = 0.407$ milligram of microbe per mm^2 is required to destroy half of the body mass in kg; but the probability (i.e. potency) of happening the above is 0.4, so $0.407 \times 0.4 = 0.163$ milligram of microbe per mm^2 is required to destroy half of the body mass in kg.

Similarly, for microbe 'Q', 0.239 milligram of microbe per mm^2; for microbe 'R', 0.17 milligram of microbe per mm^2; and for microbe 'S', 0.509 milligram of microbe per mm^2, is required to destroy half of the body mass in kg. Hence the company should target microbe S, which is most dangerous, in its first attempt.

Example [GA-2011 (2 marks)]: The quality of services delivered by a company consists of six factors as shown below in the radar diagram. The dots in the figure indicate the score for each factor on a scale of 0 to 10. The standardized coefficient for each factor is given in the parentheses. The contribution of each factor to the overall service quality is directly proportional to the factor score and its standardized coefficient. The lowest contribution among all the above factors to the overall quality of services delivered by the company is



(a) 10% (b) 20% (c) 24% (d) 40%

Solution (a): Let O: Outcome; T: Tangibles; Rel: Reliability; Res: Responsiveness; E: Empathy; A: Assurance. In the given table the contribution is the product of 'standard coefficient' and score.

Factors	O	T	Rel.	Res.	E	A
Stand. Coefficient	0.8	0.4	0.7	0.6	0.6	0.5
Score	6	5	6	6	4	6
Contribution	4.8	2	4.2	3.6	2.4	3
% of Contribution	24%	10%	21%	18%	12%	15%

So from the table we can conclude that the lowest contribution among all the given factors to the overall quality of services delivered by the company is by Tangibles which contributes to 10%.

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Example [GA-2012 (2 marks)]: The total runs scored by four cricketers P, Q, R, and S in years 2009 and 2010 are given in the following table. The player with the lowest percentage increase in total runs is

(a) P (b) Q (c) R (d) S

Player	2009	2010
P	802	1008
Q	765	912
R	429	619
S	501	701

Solution (b): The percentage increase in total runs for player P is $\frac{1008-802}{802}=25.68\%$. Similarly, the % increase in total runs for player Q is 19%, for player R is 44% and for player S is 40%. So, the player with the lowest percentage increase in total runs is Q.

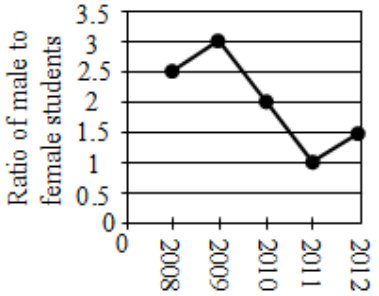
Example [GA-2013 (2 marks)]: Following table gives data on tourists from different countries visiting India in the year 2011. Which two countries contributed to the one third of the total number of tourists who visited India in 2011?

(a) USA and Japan
(b) USA and Australia
(c) England and France
(d) Japan and Australia

Country	Number of Tourists
USA	2000
England	3500
Germany	1200
Italy	1100
Japan	2400
Australia	2300
France	1000

Solution (c): The total number of tourist is $2000+3500+\cdots+1000=13500$ and one third of the total number of tourists is $\frac{1}{3}\times 13500=4500$. So total number of tourists from countries England and France adds up to 4500. Hence option (c) is correct.

Example [GA-2014 (2 marks)]: The ratio of male to female students in a college for five years is plotted in the following line graph. If the number of female students doubled in 2009, by what percent did the number of male students increase in 2009? ____



Solution: Let number of males and females in 2008 is m and f, respectively; and number of males and females in 2009 is m' and f'. So as per data given, we have $\frac{m}{f}=2.5$ …(i) and $\frac{m'}{f'}=3$ …(ii). Also $f'=2f$ …(iii). Thus from (i), (ii) and (iii), we get $\frac{m'}{m}=\frac{12}{5}\Rightarrow\frac{m'}{m}-1=\frac{12}{5}-1\Rightarrow\frac{m'-m}{m}=\frac{7}{5}=1.4$. Hence, the number of male students increase by $1.4\times 100=140\%$ in 2009.

Example [GA-2013 (2 marks)]: Following table provides figures (in rupees) on annual expenditure of a firm for two years 2010 and 2011. In 2011, which of the following two categories have registered increase by same percentage?

Category	2010	2011
Raw material	5200	6240
Power & Fuel	7000	9450
Salary & Wages	9000	12600
Plant & Machinery	20000	25000
Advertising	15000	19500
Research & Development	22000	26400

(a) Raw material and Salary & wages (b) Salary & wages and Advertising
(c) Power & fuel and Advertising (d) Raw material and Research & Development

Solution (d): The percentage increase in total expenditure for Raw materials is $(6240-5200)/5200=20\%$. Similarly, the % increase in expenditure for Power & Fuel is 35%, for Salary & Wages is 40%; for Plant & Machinery is 25%; for Advertising is 30%; and for Research & Development is 20%. So, the two categories have registered increase by same percentage are Raw material and Research & Development.

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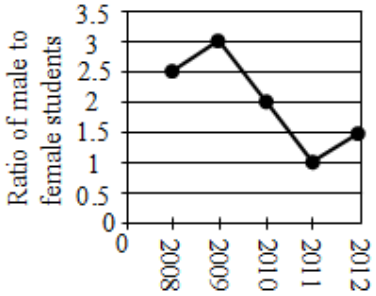
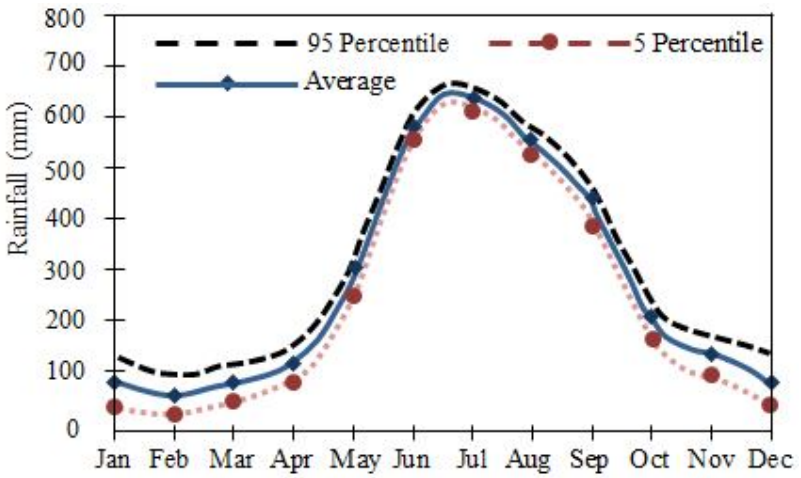
Example [GA-2014 (2 marks)]: The ratio of male to female students in a college for five years is plotted in the following line graph. If the number of female students in 2011 and 2012 is equal, what is the ratio of male students in 2012 to male students in 2011?



(a) 1:1 (b) 2:1 (c) 1.5:1 (d) 2.5:1

Solution: Let number of males and females in 2011 is m and f, respectively; and number of males and females in 2012 is m' and f'. So as per data given, we have $m/f = 1$ …(i) and $m'/f' = 1.5$ …(ii). Also $f' = f$ …(iii). Thus from (i), (ii) and (iii), we get $m'/m = 1.5/1$. Hence, the required ratio is 1.5:1.

Example [GA-2014 (2 marks)]: The monthly rainfall chart based on 50 years of rainfall in Agra is shown in the following figure. Which of the following are true? (k percentile is the value such that k percent of the data fall below that value)



(i) On average, it rains more in July than in December
(ii) Every year, the amount of rainfall in August is more than that in January
(iii) July rainfall can be estimated with better confidence than February rainfall
(iv) In August, there is at least 500 mm of rainfall

(a) (i) and (ii) (b) (i) and (iii) (c) (ii) and (iii) (d) (iii) and (iv)

Solution (b): In the question the monthly average rainfall chart for 50 years has been given. Statement (i): On average, it rains more in July than in December, which is correctly reflected from the figure. Statement (ii) may not be correct because average rainfall is given in the question. Statement (iii): from chart it is clear the gap between 5 percentile and 95 percentile from average is higher in February than that in July, so statement (iii) is correct. Statement (iv) may not be correct, because its 50 year average. So, statements (i) and (iii) are correct.

Example [GA-2014 (1 mark)]: The statistics of runs scored in a series by four batsmen are provided in the following table. Who is the most consistent batsman of these four?

Batsman	Average	Standard deviation
K	31.2	5.21
L	46.0	6.35
M	54.4	6.22
N	17.9	5.90

(a) K (b) L (c) M (d) N

Solution (a): The most consistent batsman is the one whose score is less deviated or whose standard deviation is less. So the batsman 'K' is the most consistent batsman among others.

Example [GA-2014 (2 marks)]: For submitting tax returns, all resident males with annual income below Rs 10 lakh should fill up Form P and all resident females with income below Rs 8 lakh should fill up Form Q. All people with incomes above Rs 10 lakh should fill up Form R, except non-residents with income above Rs 15 lakhs, who should fill up Form S. All others should fill Form T. An example of a person who should fill Form T is

(a) a resident male with annual income Rs 9 lakh
(b) a resident female with annual income Rs 9 lakh

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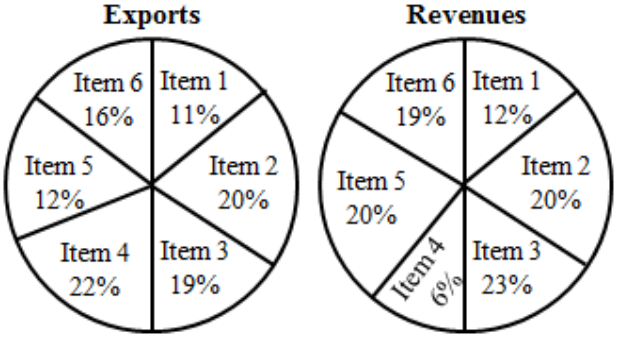
(c) a non-resident male with annual income Rs 16 lakh
(d) a non-resident female with annual income Rs 16 lakh

Solution (b): The information can be tabulated in the given table. I: Income; NR: Non-resident; R: Resident. The blank cells are the persons who fills form T. So from the given options, option (b) is correctly fit as per table.

	NR (Male)	NR (Female)	R (Male)	R (Female)
$I < 10$ lakh			P	
$I < 8$ lakh				Q
10 lakh $< I <$ 15 lakh	R	R	R	R
$I > 15$ lakh	S	S		

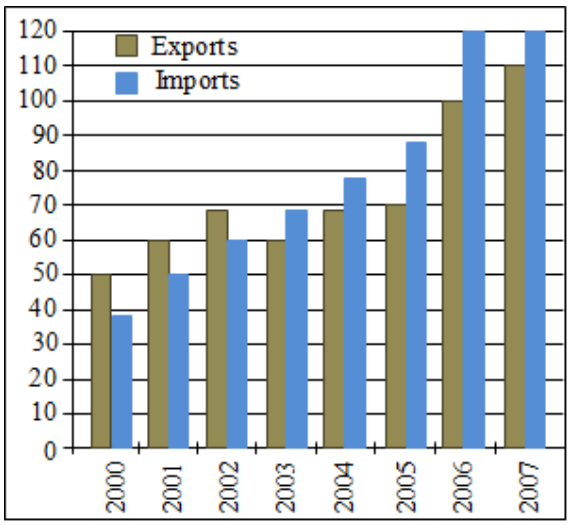
Example [GA-2014 (2 marks)]: The total exports and revenues from the exports of a country are given in the two pie charts below. The pie chart for exports shows the quantity of each item as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?



(a) 1 : 2 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1

Solution (d): The total quantity of export of item 1 is $= (11/100) \times 5 = 11/20$ lakh tonnes. So the revenue generated through export of item 1 is $= \frac{12}{100} \times 250 \times \frac{20}{11} \frac{\text{crore}}{\text{lakh ton}} = \frac{600}{11} \frac{\text{crore}}{\text{lakh ton}}$. Similarly, the total quantity of export of item 4 is $= \frac{22}{100} \times 5 = \frac{11}{10}$ lakh tonnes. So the revenue generated through export of item 4 is $= \frac{6}{100} \times 250 \times \frac{10}{11} \frac{\text{crore}}{\text{lakh ton}} = \frac{150}{11} \frac{\text{crore}}{\text{lakh ton}}$. So the required ratio is $\frac{600/11}{150/11} = \frac{4}{1}$.

Example [GA-2014 (2 marks)]: The exports and imports (in crores of Rs.) of a country from 2000 to 2007 are given in the following bar chart. If the trade deficit is defined as excess of imports over exports, in which year is the trade deficit 1/5th of the exports?



(a) 2005 (b) 2004
(c) 2007 (d) 2006

Solution (d): As the trade deficit is defined as excess of imports over exports. For the years 2000, 2001 and 2002, there is no excess of imports over exports, so there is no trade deficit for these years.

For the year 2003, trade deficit, $\text{TD} = \frac{\text{import} - \text{export}}{\text{export}} = \frac{68 - 60}{60} = \frac{2}{15}$. Similarly, for the year 2004, $\text{TD} = \frac{1}{7}$; for the year 2005, $\text{TD} = \frac{2}{7}$; for the year 2006, $\text{TD} = \frac{1}{5}$; for the year 2007, $\text{TD} = \frac{1}{11}$.

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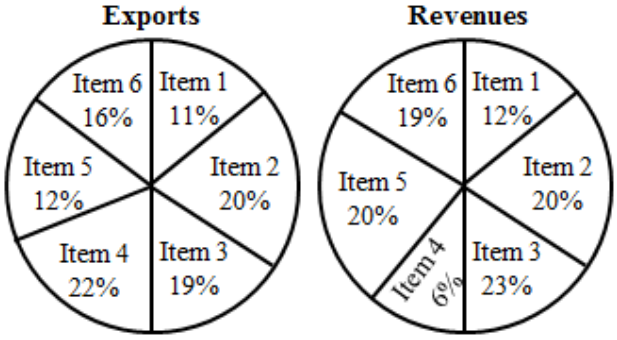
Example [GA-2014 (2 marks)]: The total exports and revenues from the exports of a country are given in the two charts shown below. The pie chart for exports shows the quantity of each item exported as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 500 thousand tonnes and the total revenues are 250 crore rupees. Which item among the following has generated the maximum revenue per kg?



(a) Item 2 (b) Item 3 (c) Item 6 (d) Item 5

Solution (d): The total quantity of export of item 1 is $=\frac{11}{100}\times 5=\frac{11}{20}$ lakh tonnes. So the revenue generated through export of item 1 is $=\frac{12}{100}\times 250\times\frac{20}{11}\frac{\text{crore}}{\text{lakh ton}}=\frac{600}{11}=54.54\frac{\text{crore}}{\text{lakh ton}}$.

Similarly, the revenue generated through export of item 2 is $=50\,\text{crore}/\text{lakh ton}$;

The revenue generated through export of item 3 is $=60.52\,\text{crore}/\text{lakh ton}$;

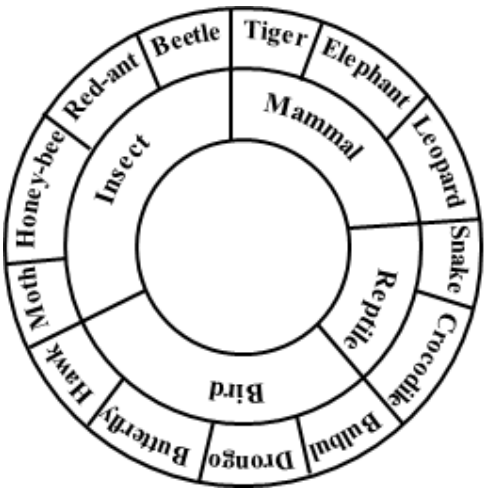
The revenue generated through export of item 4 is $=13.63\,\text{crore}/\text{lakh ton}$;

The revenue generated through export of item 5 is $=83.33\,\text{crore}/\text{lakh ton}$;

The revenue generated through export of item 6 is $=59.37\,\text{crore}/\text{lakh ton}$.

So, item 5 has generated the maximum revenue per kg.

Example [GA-2014 (2 marks)]: The multi-level hierarchical pie chart shows the population of animals in a reserve forest.



(i) Butterflies are birds
(ii) There are more tigers in this forest than red ants
(iii) All reptiles in this forest are either snakes or crocodiles
(iv) Elephants are the largest mammals in this forest

The correct conclusions from this information are:
(a) (i) and (ii) only
(b) (i), (ii), (iii) and (iv) only
(c) (i), (iii) and (iv) only
(d) (i), (ii) and (iii) only

Solution (d): In the given pie chart, we can confirm that the statements (i), (ii) and (iii) are correct; on the other hand there is no information that elephants are the largest mammals in the forest, so statement (iv) is not concluded from the give pie chart.

Example [GA-2014 (2 marks)]: Lights of four colours (red, blue, green, yellow) are hung on a ladder. On every step of the ladder there are two lights. If one of the lights is red, the other light on that step will always be blue. If one of the lights on a step is green, the other light on that step will always be yellow. Which of the following statements is not necessarily correct?
(a) The number of red lights is equal to the number of blue lights
(b) The number of green lights is equal to the number of yellow lights
(c) The sum of the red and green lights is equal to the sum of the yellow and blue lights
(d) The sum of the red and blue lights is equal to the sum of the green and yellow lights

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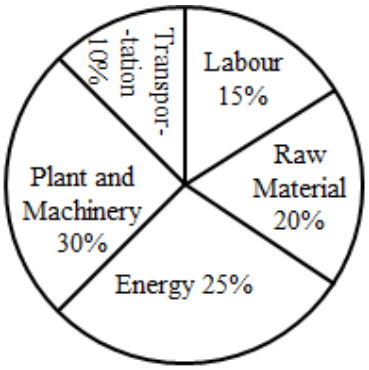
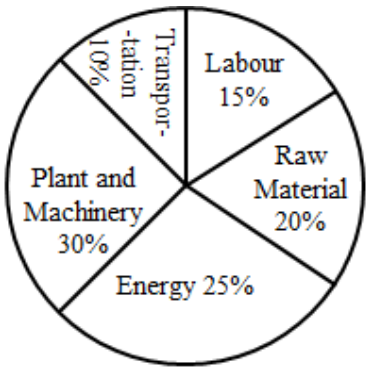
Solution (d): If a ladder contains only red and blue colour lights then the statement in option (a) is correct. If a ladder contains only green and yellow colour lights then the statement in option (b) is correct. The statement in option (c) is a combination of statements in options (a) and (b), so option (c) is also correct. Now suppose a ladder contains 5 steps; in three steps we have red and blue coloured light, in two steps we have green and yellow coloured light, so the statement in option (d) is not satisfied while other three are satisfied; and thus option (d) is not necessarily correct.

Example [GA-2014 (2 marks)]: A firm producing air purifiers sold 200 units in 2012. The following pie chart presents the share of raw material, labour, energy, plant & machinery, and transportation costs in the total manufacturing cost of the firm in 2012. The expenditure on labour in 2012 is Rs. 4,50,000. In 2013, the raw material expenses increased by 30% and all other expenses increased by 20%. If the company registered a profit of Rs. 10 lakhs in 2012, at what price (in Rs.) was each air purifier sold? _____



Solution: Let the total expenditure in 2012 is ₹ x, so from the given data we have, $\frac{15}{100}x = 450000 \Rightarrow x = 3000000$. The company registered a profit of ₹ 10 lakhs in 2012. So the total selling price of purifiers in 2012 is ₹ $(3000000 + 1000000) = ₹\,4000000$. As there are 200 units of purifiers produced in 2012 so the selling price of each purifier is $\frac{4000000}{200} = ₹\,20000$.

Example [GA-2014 (2 marks)]: A firm producing air purifiers sold 200 units in 2012. The following pie chart presents the share of raw material, labour, energy, plant & machinery, and transportation costs in the total manufacturing cost of the firm in 2012. The expenditure on labour in 2012 is Rs. 4,50,000. In 2013, the raw material expenses increased by 30% and all other expenses increased by 20%. What is the percentage increase in total cost for the company in 2013? _____



Solution: Let the total cost for the company in 2012 is ₹ $100x$. Raw material increases by 30% in 2013, i.e. the share of raw material is $= \frac{20}{100} \times x\left(1 + \frac{30}{100}\right) = 0.26x$. Other expenses increases by 20% in 2013, i.e. the share of other expenses is $= \frac{80}{100} \times x\left(1 + \frac{20}{100}\right) = 0.96x$. Thus the total cost for the company in 2013 is $0.26x + 0.96x = 1.22x$. Hence, the % increase in total cost for the company in 2013 is $= \frac{1.22x - x}{x} \times 100 = 22\%$.

Example [GA-2015 (1 mark)]: Based on the given statement, select the most appropriate option to solve the given question. If two floors in a certain building are 9 feet apart, how many steps are there in a set of stairs that extends from the first floor to the second floor of the building? **Statement I:** Each step is $3/4$ foot high; **Statement II:** Each step is 1 foot wide

(a) Statement I alone is sufficient, but statement II alone is not sufficient

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(b) Statement II alone is sufficient, but statement I alone is not sufficient
(c) Both statements together are sufficient, but neither statement alone is sufficient
(d) Statement I and II are not sufficient

Solution (d): As there is no information about the length of steps, so both statements are not sufficient to find the total number of stairs.

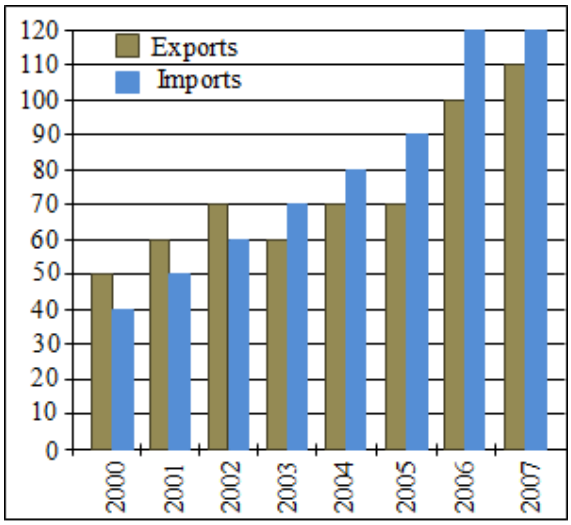
Example [GA-2015 (1 mark)]: An electric bus has onboard instruments that report the total electricity consumed since the start of the trip as well as the total distance covered. During a single day of operation, the bus travels on stretches M, N, O, and P, in that order. The cumulative distances travelled and the corresponding electricity consumption are shown in the Table below. The stretch where the electricity consumption per km is minimum is

(a) M (b) N (c) O (d) P

Stretch	Cumulative distance (km)	Electricity used (kWh)
M	20	12
N	45	25
O	75	45
P	100	57

Solution (b): The electricity consumption per km for the stretch 'M' is $12/20 = 0.6$. Similarly, electricity consumption per km for the stretch 'N' is 0.55; for 'O' is 0.6; and for 'P' is 0.57. The stretch where the electricity consumption per km is minimum is 'N'.

Example [GA-2015 (2 marks)]: The exports and imports (in crores of Rs.) of a country from the year 2000 to 2007 are given in the following bar chart. In which year is the combined percentage increase in imports and exports the highest? _____



Solution: The percentage increase in exports in 2006 is $= (100-70)/70 = 42.85\%$; and the percentage increase in imports in 2006 is $= (120-90)/90 = 33.33\%$, which are more than any year. So answer is 2006.

Alternative method: If we carefully analyse the bar graph we find there is large gap between 2005 and 2006 for both import and export, than any other successive year. So the percentage increase will maximum for the year 2006.

Example [GA-2015 (2 marks)]: Read the following table giving sales data of five types of batteries for years 2006 to 2012 (where, Y: Year; T: Type). Out of the following, which type of battery achieved highest growth between the years 2006 and 2012?

(a) V (b) III (c) II (d) I

Y/T	I	II	III	IV	V
2006	75	144	114	102	108
2007	90	126	102	84	126
2008	96	114	75	105	135
2009	105	90	150	90	75
2010	90	75	135	75	90
2011	105	60	165	45	120
2012	115	85	160	100	145

Solution (d): From the data table, we can analyse that the battery type II and IV did not achieved the growth. The percentage growth of type I battery is $= (115-75)/75 = 53.33\%$; similarly, the percentage growth of type III battery is $= (160-114)/114 = 40.35\%$; percentage growth of type V battery is $= (145-108)/108 = 34.26\%$. Thus type I battery achieved highest growth between the years 2006 and 2012.

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Example [GA-2016 (2 marks)]: A shaving set company sells 4 different types of razors, Elegance, Smooth, Soft and Executive. Elegance sells at Rs. 48, Smooth at Rs. 63, Soft at Rs. 78 and Executive at Rs. 173 per piece. The table below shows the numbers of each razor sold in each quarter of a year.

Quarter \ Product	Elegance	Smooth	Soft	Executive
Q1	27300	20009	17602	9999
Q2	25222	19392	18445	8942
Q3	28976	22429	19544	10234
Q4	21012	18229	16595	10109

Which product contributes the greatest fraction to the revenue of the company in that year?

(a) Elegance (b) Executive (c) Smooth (d) Soft

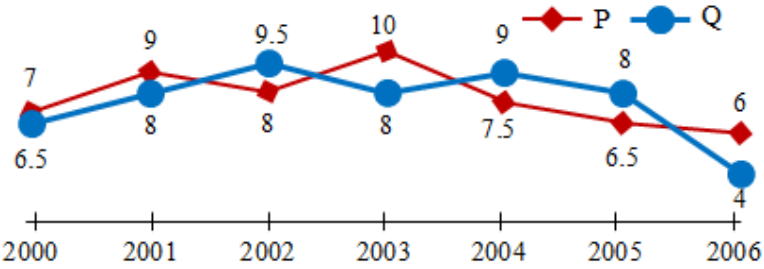
Solution (b): In the given table the total is the total number of units sold for all four types of razor. For e.g. in a year the total number of elegance type of razors sold is $= 27300 + 25222 + 28976 + 21012 = 102510$.

Now revenue is the amount for a particular types of razor sold. For e.g. the revenue generated by Elegance type of razor is $= 102510 \times 48 = 4920480$.

Quarter \ Product	Elegance	Smooth	Soft	Executive
Q1	27300	20009	17602	9999
Q2	25222	19392	18445	8942
Q3	28976	22429	19544	10234
Q4	21012	18229	16595	10109
Total	**102510**	**80059**	**72186**	**39284**
Revenue	**4920480**	**5043717**	**5630508**	**6796132**

Hence from the table, we can say that the greatest fraction to the revenue of the company in that year is generated by Executive type of razor. So option (b) is correct.

Example [GA-2016 (2 marks)]: Two finance companies, P and Q, declared fixed annual rates of interest on the amounts invested with them. The rates of interest offered by these companies may differ from year to year.



Year-wise annual rates of interest offered by these companies are shown by the line graph provided below. If the amounts invested in the companies, P and Q, in 2006 are in the ratio 8:9, then the amounts received after one year as interests from companies P and Q would be in the ratio:

(a) $2:3$ (b) $3:4$ (c) $6:7$ (d) $4:3$

Solution (d): The ratio of amount invested in the companies of P and Q in 2006 is $8:9$.

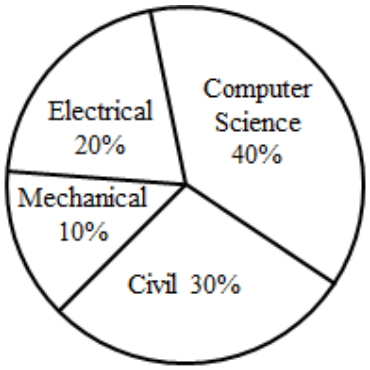
The rate of interest of companies P and Q in 2006 is 6% and 4%, respectively.

The ratio of amount received after one year by P and Q companies in 2006 is given by

$6\%\text{ of }8 : 4\%\text{ of }9 \equiv (6/100)\times 8 : (4/100)\times 9 \equiv 6\times 8 : 4\times 9 \equiv 4:3$.

So option (d) is correct.

Example [GA-2015 (2 marks)]: The pie chart below has the breakup of the number of students from different departments in an engineering college for the year 2012. The proportion of male to female students in each department is 5:4. There are 40 males in Electrical Engineering. What is the difference between the number of female students in the Civil department and the female students in the Mechanical department? _____



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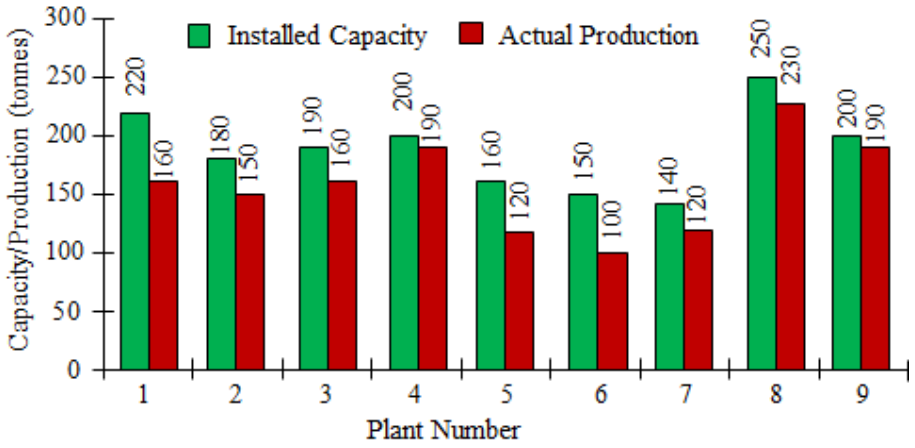
Solution: Total number of female students in Electrical is $40\times\frac{4}{5}=32$. So total number of students in Electrical Engineering is $40+32=72$. Thus total number of students in engineering college is $\frac{20}{100}\times x=72\Rightarrow x=360$. So total number of students in Civil department is $\frac{30}{100}\times 360=108$; and in Mechanical department is $\frac{10}{100}\times 360=36$. Thus number of female students in Civil department is $\frac{4}{9}\times 108=48$; and in Mechanical department is $\frac{4}{9}\times 36=16$. So the difference between the number of female students in the Civil department and the female students in the Mechanical department is $48-16=32$.

Example [GA-2016 (2 marks)]: The following graph represents the installed capacity for cement production (in tonnes) and the actual production (in tonnes) of nine cement plants of a cement company. Capacity utilization of a plant is defined as ratio of actual production of cement to installed capacity. A plant with installed capacity of at least 200 tonnes is called a large plant and a plant with lesser capacity is called a small plant. The difference between total production of large plants and small plants, in tonnes is ____.



Solution: A plant with installed capacity of at least 200 tonnes is called a large plant and a plant with lesser capacity is called a small plant.
So plants 1, 4, 8, 9 are large plants; and plants 2, 3, 5, 6, 7 are small plants. So from the bar graph, we have:
Actual production of large plants $=160+190+230+190=770$ tonnes
Actual production of small plants $=150+160+120+100+120=650$ tonnes
So, difference between total production of large plants and small plants $=770-650=120$ tonnes.

Exercise 12.1

In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

1. What is the respective ratio of total number of women playing football to the men playing volley ball based on the data provided in the table?

(a) 2 : 3 (b) 23 : 36
(c) 24 : 37 (d) 11 : 18

Games	Number of percentage		
	Children	Women	Men
Hockey	35%	159	166
Tennis	632	168	20%
Football	163	36%	221
Volley Ball	261	34%	37%
Cricket	36%	77	435

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2. Table A indicates the readership magazines (in ten thousands) from 2001 to 2004 and Table B indicates the number of magazines published during this period. G: General; S: Sports; F: Films: B: Business; E: English; H: Hindi.

Table A

	2001		2002		2003		2004	
	E	H	E	H	E	H	E	H
G	10	12	15	16	20	18	25	20
S	4	2	6	4	10	7	12	8
F	6	8	9	12	10	15	12	18
B	3	1	4	1.5	6	2.5	8	5

Table B

	2001		2002		2003		2004	
	E	H	E	H	E	H	E	H
G	12	10	15	14	17	15	29	16
S	3	2	5	3	7	4	8	6
F	3	4	5	6	5	7	6	8
B	4	2	5	3	6	4	7	8

In 2002, as against 2001, readership magazine declined for which category?

(a) Sport (b) General (c) Business (d) Films

3. Based on the data, about average hourly wage (in ₹) by age group, provided in the table, what was the difference between the average wages of males and of females for the 21 – 23 years age group? _____

Years	18-20 Years		21 – 23 Years	
	Male	Female	Male	Female
2003	15.1	15.1	29.7	25.1
2004	12.4	13.4	21.0	19.1
2005	10.0	13.8	14.7	16.9
2006	11.0	13.4	18.0	20.5
2007	21.2	16.3	29.4	32.7
2008	15.0	21.0	32.1	33.9

4. Based on the data, about performance of leading opener in 20 one-day cricket matches, given in the table, what is the difference between the average runs of top two openers in terms of highest runs, if matches having 0's were ignored?

Openers	Total Runs	Highest Runs	No. of matches with runs		
			≥ 100	50-99	0's
A	994	141	5	3	1
B	751	130	1	8	2
C	414	52	-	2	3
D	653	94	-	4	1
E	772	85	-	7	-

(a) 11.1 (b) 13.7 (c) 4.7 (d) 10.59

5. The students, in 3rd years B.Tech., are asked to select four optional subjects from the seven given subjects. There are ten students whose roll numbers are from 1 to 10. They have selected four optional subjects each. Their subjects selected are indicated by 'Y'. Based on the data given in the table, which optional subject was chosen by the maximum number of students?

Courses	Roll Numbers									
	1	2	3	4	5	6	7	8	9	10
A	Y		Y	Y		Y		Y	Y	Y
B		Y	Y		Y	Y		Y		
C			Y			Y	Y		Y	Y
D	Y	Y		Y	Y		Y	Y		
E		Y					Y		Y	Y
F	Y		Y	Y	Y		Y	Y		
G	Y	Y		Y	Y	Y			Y	Y

(a) E (b) A (c) B (d) D

6. The given table provides data about the availability and demand (in '000 tonnes) for various categories of steel in Indian Railways. Which one of the following statement is necessarily true?

S.No.	Category	1999-2000		2003-2004	
		D	A	D	A
1	Shapes	6960	5725	9745	9360
2	Flats	4360	5020	6300	6600
3	Railway Material	400	550	450	560

D: Demand; A: Availability

(a) The demand for shapes as a percentage of the total demand for steel was almost the same for 1999 – 2000 and 2003 – 2004

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(b) The shortage of shapes is only due to excess availability of flats and railway material
(c) The demand for railways materials as a percentage of the total demand for steel was less in 1999 – 2000 than in 2003 – 2004.
(d) The rate of growth in demand for shapes is greater than the rate of growth in supply of shapes.

7. The forecasts of the World and Asian energy demand for the years 2005, 2010 and 2020 are given in the table. The demand is given in million barrels per day crude oil equivalent.

For which source of energy is the demand in 2020 as a ratio of demand in 2005 in the Asian region the greatest?

(a) Natural Gas
(b) Nuclear
(c) Solid Fuels
(d) Hydropower

	2005		2010		2020	
	W	A	W	A	W	A
Petroleum	56	8	86	11.5	108	18
Natural Gas	38	1.5	67	2.5	96	4.5
Solid Fuels	46	6	54	13	67	15.4
Nuclear	8	2	9	4.8	12	5.5
Hydropower	12	1.5	14	2.2	17	4.6
Total	160	19	230	34	300	48

W: World; A: Asia

8. The circulation in thousands of five newspapers in the four states during 2002 – 2003 is given in the table. Of the five newspapers, which has the highest number of circulation?

(a) A (b) B (c) C (d) D

Newspapers	Kerala	Punjab	UP	MP
A	123	227	96	78
B	105	220	117.2	97
C	12.2	14.6	9.7	17.2
D	82.4	44	145	9.3
E	24.4	23	10	100

9. The following table gives the data about classification of intelligence. In which category will the Data: 140, 127, 135, 120, 125, 131, 139, 144, 138 classify for IQ scores?

(a) Superior and Very Superior
(b) Bright and Superior
(c) Average and Dull
(d) No given category

I.Q.	Classification	% Included
130 and above	Very Superior	2.2
120 – 129	Superior	6.7
110 – 119	Bright normal	16.1
90 – 109	Average	50
80 – 89	Dull normal	16.1
70 – 79	Border line	6.7
60 and below	Mentally defective	2.2

10. The following table shows the trends in the relative value in the market of group of commodities from 1999 to 2003.

Which commodity showed the least variation in value of the period 1999 – 2003?

(a) Cereals
(b) Gas
(c) Vegetables
(d) Fruits

Commodities	1999	2000	2001	2002	2003
Milk	95	92	86	72	76
Cereals	75	68	62	66	60
Fats and Oils	76	70	68	62	58
Gas	82	76	100	98	96
Vegetables	80	62	64	84	88
Fruits	79	74	72	66	73

11. Study the data given in the following table:

Commodity	% of Protein	% of Carbohydrate	% of Fat	Cost per 100 grams
Food A	10	20	30	₹ 1.80
Food B	20	15	10	₹ 3.00
Food D	20	10	40	₹ 2.75

All of the following diets would supply at least 75 grams of fat. Which of the diets costs least?

(a) 300 gram of A
(b) 200 gram of C
(c) 150 gram of A and 100 gram of C
(d) 500 gram of B and 100 gram of A

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12. The table shows the number of emergencies attended by 6 fire brigade substations during May – October 2002.

Substation	May	June	July	Aug	Sep	Oct
A	12	15	17	21	13	17
B	18	21	15	18	18	19
C	10	11	19	21	23	18
D	17	17	19	12	18	10
E	12	15	18	10	21	11
F	14	15	12	13	18	19

Which two months aggregated over 36% of the total number of emergencies in the six-month period?

(a) May and June
(b) July and October
(c) July and September
(d) August and September

13. Loan disbursed by five banks (in ₹ crore) are given in the table. In which year was the distribution of loans of all the banks put together least compared to the average disbursement of loans over the years?

Banks	Year				
	1990	**1991**	**1992**	**1993**	**1994**
A	18	23	45	30	70
B	27	33	18	41	37
C	29	29	22	17	11
D	31	16	28	32	43
E	13	19	27	34	42

(a) 1990 (b) 1991
(c) 1992 (d) 1994

14. The Hotel Company of India (HCI) owns seven Hotels with the same capacity. The occupancy rates across the seven hotels are given in the following table:

Hotel Name	Pleasant Stay	Dessert Palace	Black Lagoon	Lake View	Classic	Radiant	Plaza
2001	65%	55%	70%	49%	71%	47%	59%
2000	43%	72%	76%	46%	64%	64%	63%
1999	63%	71%	65%	61%	58%	66%	65%
1998	72%	68%	60%	64%	61%	72%	49%
1997	81%	67%	64%	63%	59%	69%	45%

Based on the data given in the above table, which one of the following statements is true?

(a) The average occupancy rate of Plaza was greater than that of Lake View
(b) The greatest average occupancy rate was witnessed in Pleasant Stay
(c) The average occupancy rate for Dessert Palace is greater than that of Black Lagoon
(d) All the above statements are false

15. The following table shows the monthly sales of cars of five types by five automobile shops. Based on the data given in the table, which shop has the lowest sale of both type B and E as compared to other shops?

Type	Automobile Shops				
	P	**Q**	**R**	**S**	**T**
A	1250	3500	1360	2240	210
B	2100	3080	3700	4200	920
C	3460	4400	4860	4860	4760
D	900	680	700	1120	600
E	300	440	1200	1250	280

(a) P (b) Q (c) R (d) T

16. The given table describes the speed of a train over a three hour period, where the time period is given in minutes and speed is given in km/h. At time t, measured in minutes, after the beginning of the time period which of the following gives the speed of the train in accordance with the table?

	Speed of a train over a 3-hour period							
Time Period	0	30	45	60	90	120	150	180
Speed	64	72	76	80	88	96	104	112

(a) $1/6t$ (b) $64 + 1/6t$ (c) $64 + t$ (d) None of these

17. The given table provides the data about

Year	Name of the company

trend in sales of four companies. The amount given in lakhs of rupees. Which company has shown consistently an increasing sales average?

(a) Alpha (b) Beta
(c) Gamma (d) Delta

	Alpha	Beta	Gamma	Delta
1986	12	2	18.5	12
1987	10	5	15	16
1988	18	7.5	16.5	15
1989	20	11.5	14.5	36
1990	25	15	50	48

18. The data in the following table describes the frequency distribution of workers in a factory and number of children of each worker. Based on the data given in table, the number of illiterate workers with less than 4 children is _____.

No. of children	No. of workers	No. of illiterates
01	40	15
02	60	25
03	35	20
04	40	20
05	15	10
06	10	05

19. The given table provides the data about the number of five cars produced and rejected (for defects) by a company over the years. P: Produced; R: Rejected.

Car	A		B		C		D		E	
Year	P	R	P	R	P	R	P	R	P	R
1983	20	2	50	3	15	0.5	80	5	60	4
1984	35	3	45	2	20	0.55	75	4	58	4
1985	15	0.5	40	2.5	17	0.75	58	2	62	3.5
1986	25	0.25	42	2.3	25	1.5	65	3	40	1.5
1987	30	1.5	48	2.5	30	2	68	3	45	2
1988	27	1.5	41	2.1	26	1.75	72	3.5	50	2.5

In the case of 'B' type cars in which year was the ratio of rejection to production the highest among the given years?

(a) 1983 (b) 1984 (c) 1985 (d) 1987

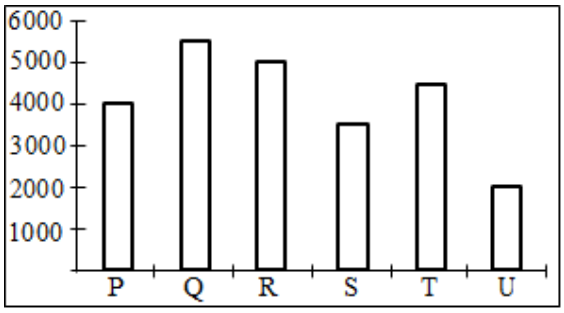
20. The table gives the data about year-wise and discipline-wise for candidates selected in an industry (in thousands). Which discipline has shown the greatest rate of increase in its selection from 1994 to 1996?

	1991	1992	1993	1994	1995	1996
Science	16	20	25	15	14	16
Arts	4	8	9	10	11	13
Commerce	8	12	12	11	15	13
Law	7	9	5	3	6	8
Computer	10	14	18	20	25	30
Others	1	1	2	1	1	1

(a) Arts (b) Computer (c) Law (d) Commerce

21. The number of peoples from different cities (P, Q, ⋯, U) is shown in the bar graph below.

Number of people contributing from how many cities from less than 18% of the total number of people contributing from all the cities together?



22. Median reach among population in various cities is shown in the graph. All figures are in numbers.

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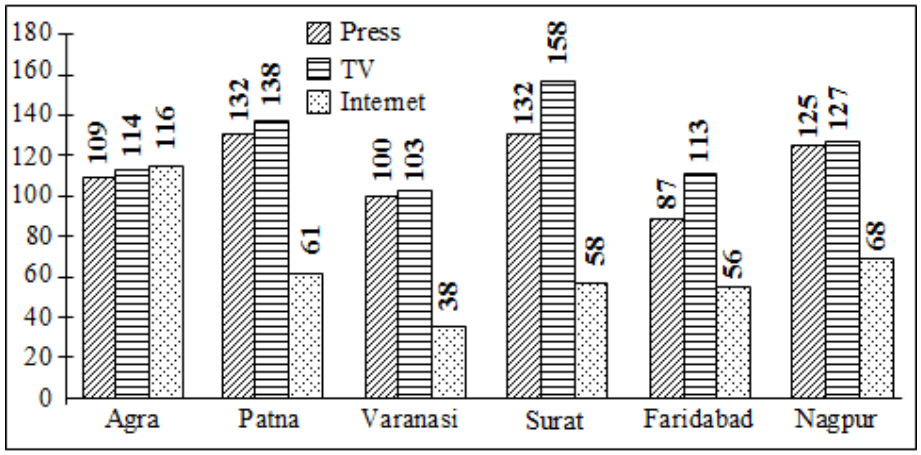
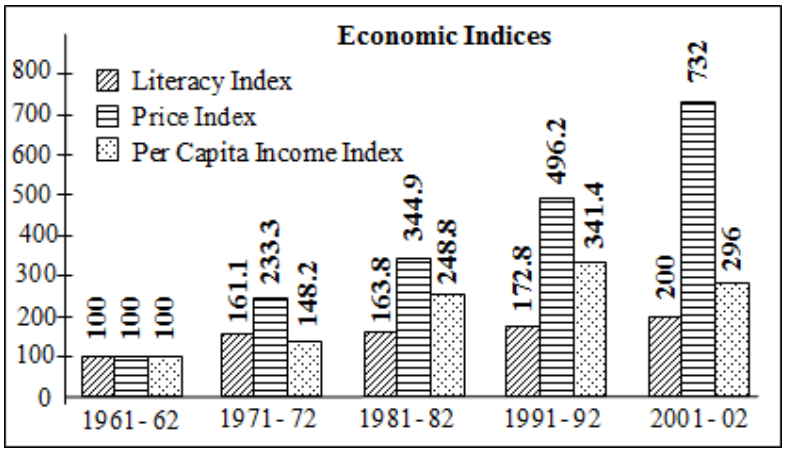


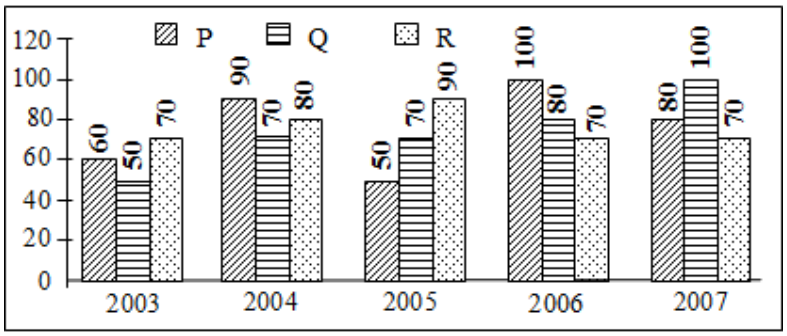
What is the lowest percentage (in %) response received from any city in any of the media segments? _____

23. The economic indices for the period 1961-62 to 2001-02 is given in the following bar graph. Of the three economic indices which index for which period shows the maximum percentage increase as compared to the previous period?



(a) Literacy, 1971-72
(b) Price, 2001-02
(c) Per capita income, 1981-82
(d) Price, 1971-72

24. The following bar graph indicates the production of sugar (in lakh tonnes) by three different sugar companies P, Q and R over the year 2003 to 2007.



The ratio of the average production of Company P during the years 2005 to 2007 to the average production of Company Q for the same period is

(a) 15 : 17 (b) 23 : 25 (c) 27 : 29 (d) 9 : 11

25. The following bar graph shows the birth rates and death rates (per 1000 person) in the year 2008 for various countries. The rate of growth of population = Birth rate – Death rate.

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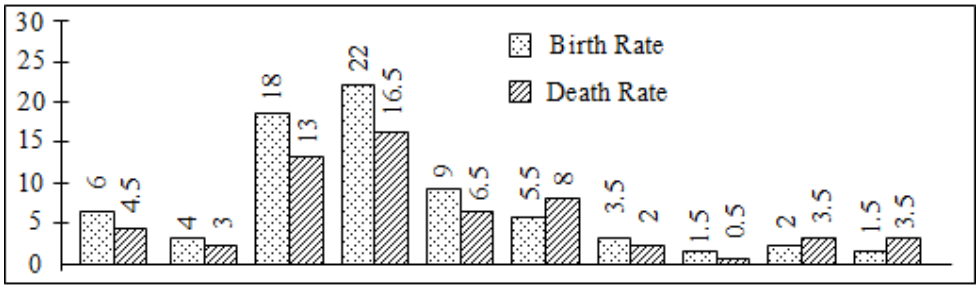
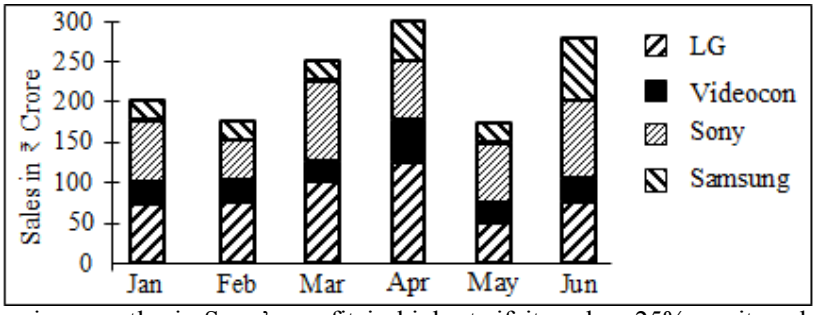


If the rate of growth of population is expressed in percentage terms instead of number per 1000 persons, then among the countries with a positive growth rate, the rate of growth for the country whose population is growing by the fastest rate is how many percentage points more than that of the country whose population is growing by the slowest rate? _____

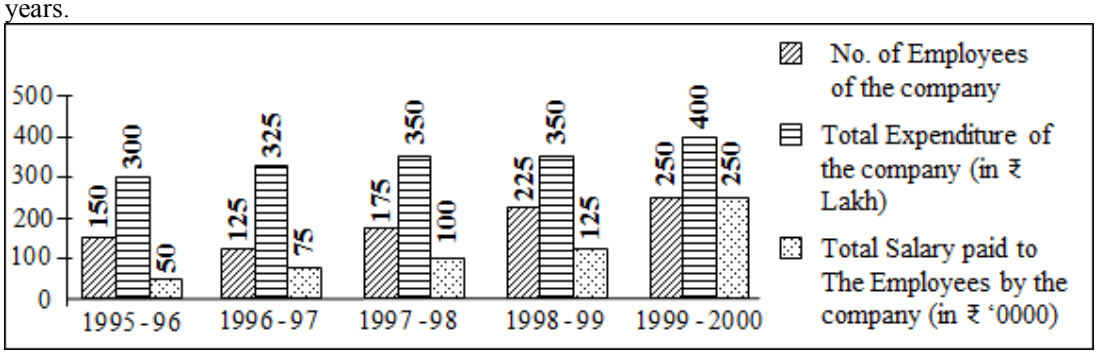
26. Monthly sales turnover of TVs of LG, Videocon, Sony and Samsung from January to June, 2008 is shown in the following bar graph.



In which of the following months is Sony's profit is highest, if it makes 25% on its sales turnover on each months?

(a) January and May (b) May
(c) February, May and June (d) March, April and June

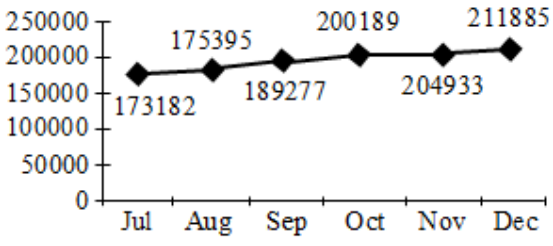
27. The bar graph below gives the data of the number of employees working in a Company, the total expenditure of the Company, and the total salary paid to the employees by the Company over the years.



What was the difference between the average of the total salaries paid by the Company over the given years and the total salary paid by the company in the year 1997 – 98.

(a) ₹ 200000 (b) ₹ 250000 (c) ₹ 400000 (d) ₹ 150000

28. The following line graph shows the circulation growth of a magazine from July to December. During November and December, there was an even growth rate, the average of which is _____%.



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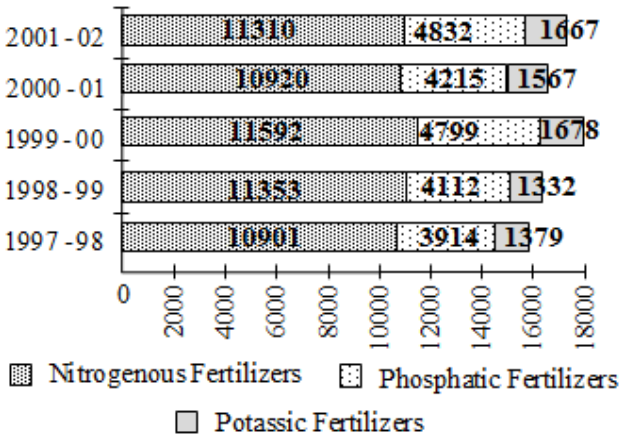
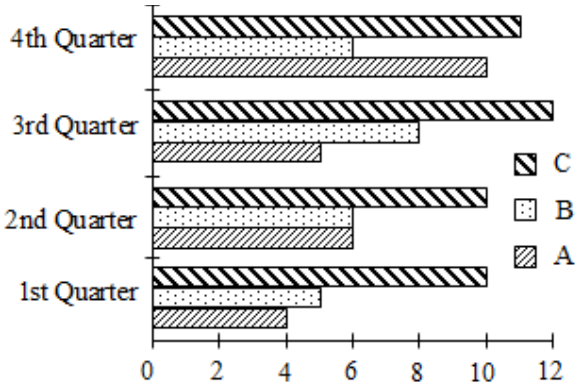
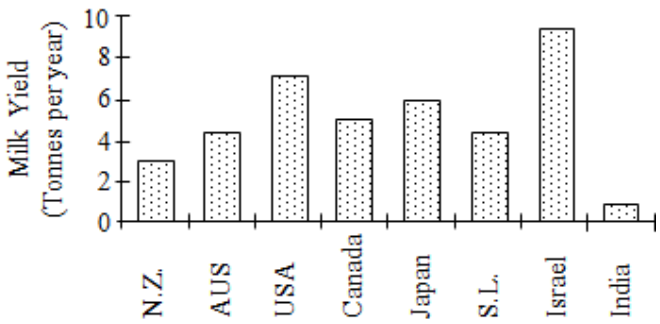
29. The following bar graph shows the consumption of fertilizers in nutrient terms.
Total consumption of Nitrogenous Fertilizers, Phosphatic Fertilizers and Potassic Fertilizers during the period 1997-2002 has been in the ratio of
(a) 10 : 28 : 74
(b) 37 : 14 : 5
(c) 5 : 2 : 1
(d) 37 : 28 : 7



30. The following bar graph gives the revenue data for the three companies A, B, C.
Which quarter has the highest average revenue?
(a) First
(b) Second
(c) Third
(d) Fourth

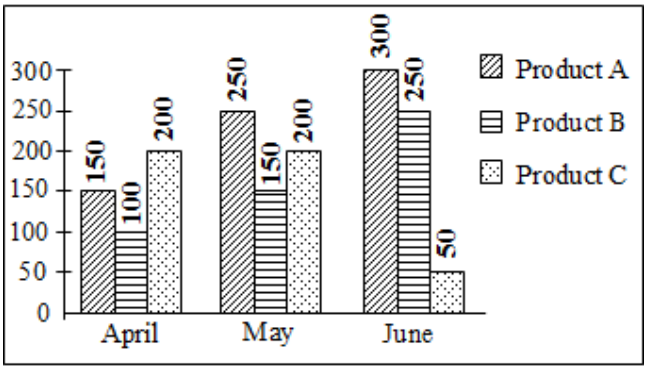


31. The given bar graph describes about the milk yield for major countries per head of cattle per year. Based on the given data, which one of the following statement is correct?



(a) Per cattle yield of milk in India is as much as that of NZ
(b) USA produces one tonne more milk per cattle than Japan
(c) Per cattle yearly yield of milk in Australia and SL equals that of Israel
(d) Yearly per cattle yield of milk in Israel is three times that of NZ

32. The following bar graph shows the production of items A, B and C during three months. The total production during the months of April, May and June of the three products A, B and C are in the ratio of
(a) 7 : 5 : 7
(b) 7 : 4 : 4.5
(c) 7 : 4.5 : 4
(d) 4.5 : 6 : 5



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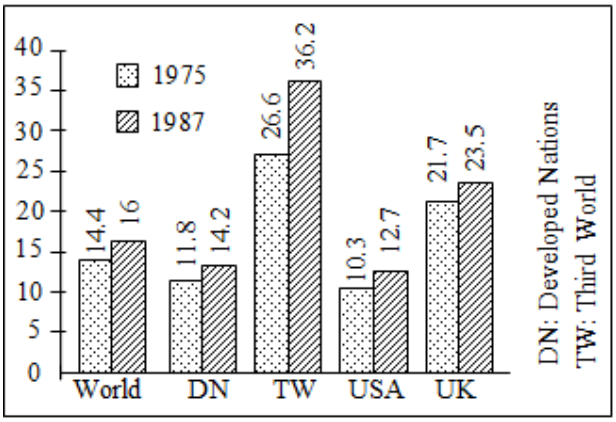
33. The following bar graph depicts the annual rates of inflation in percentage for 1975 and 1987. Comparing the figures for USA with developed nations, it can be concluded that

(a) USA had better control on inflation
(b) Developed nations had better control on inflation
(c) The control on inflation rate continues to be the same for the USA and for the developed nations
(d) No conclusion can be drawn

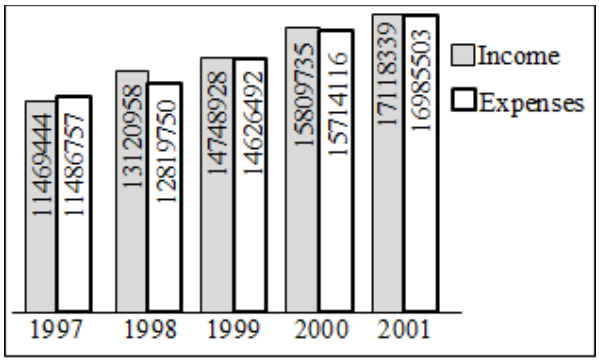


34. The following bar graph gives the data about income and expenses for years 1997 – 2001 of a company. Consider the following statement:

(i) The company made a profit in all the years shown in the graph
(ii) The company's profit increased every year between 1999 and 2001
(iii) The company's expenses increased every year shown in the graph

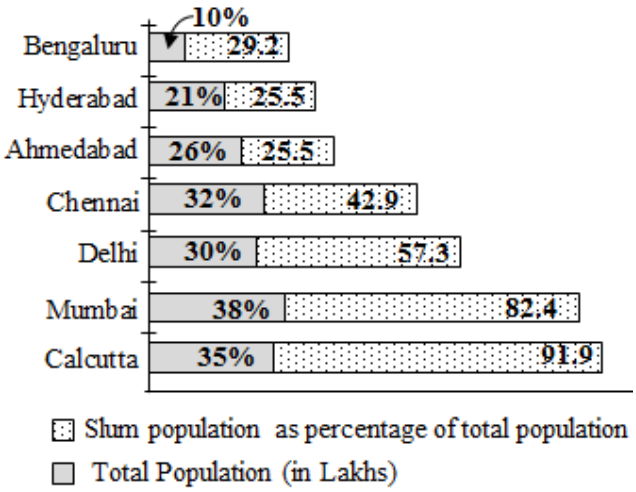
Which of the above statement(s) can be inferred from the bar graph?

(a) Only (i) (b) Only (ii) (c) Only (iii) (d) All of these



35. The slum population as a percentage of total population in Metropolis is given in the following bar graph. The slum population of Delhi was more than 3 times the slum population of

(a) Hyderabad
(b) Ahmedabad
(c) Bengaluru
(d) Chennai



36. The off-take of Natural Gas in India for various categories of energy purposes in million of cubic metres for the years 2007 and 2008 is depicted in the pie charts given below. The total of all the categories in million cubic metres is 20855 for the year 2007 and 22647 for the year 2008.

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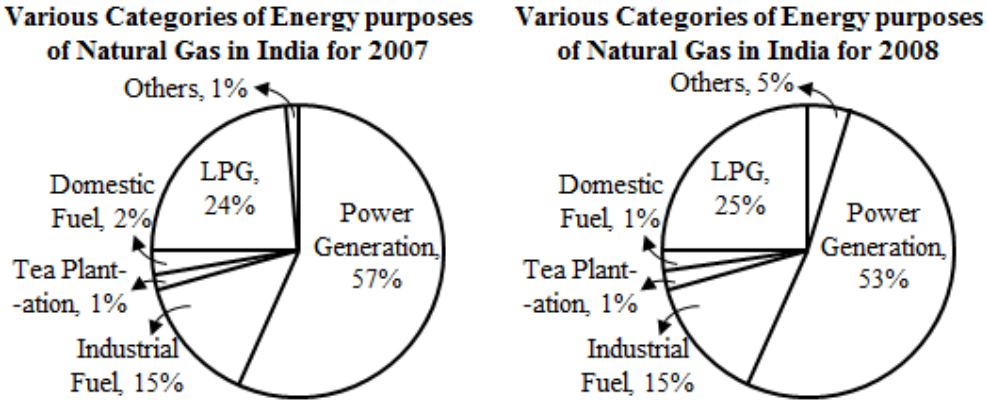
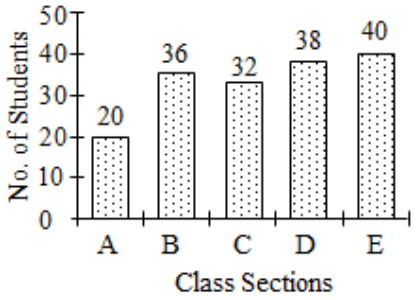

Various Categories of Energy purposes of Natural Gas in India for 2007
Others, 1%
LPG, 24%
Domestic Fuel, 2%
Power Generation, 57%
Tea Plant--ation, 1%
Industrial Fuel, 15%
Various Categories of Energy purposes of Natural Gas in India for 2008
Others, 5%
LPG, 25%
Domestic Fuel, 1%
Power Generation, 53%
Tea Plant--ation, 1%
Industrial Fuel, 15%

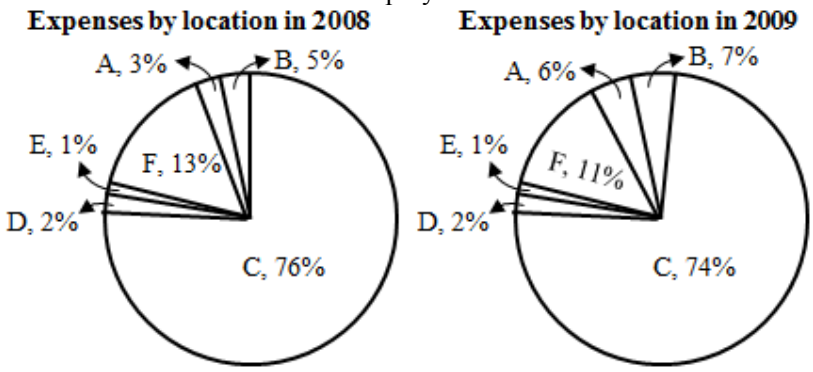
The Natural Gas was wasted by 50% in 2007 and 40% in 2008 of the other's category in both the years. What is the percentage (in %) increase or decrease in wastage of Natural Gas from 2007 to 2008? _____

37. The following bar graph shows the number of students in five sections A, B, C, D and E of a class in a school. If the students were to be uniformly divided in each section, for which section would the strength change most drastically?

(a) A
(b) C
(c) D
(d) E



38. The location wise distribution of employees in a company for the years 2008 and 2009 are given below in pie charts. The total employee strength of the company in 2008 was 90000 and there was a 20% increase in the number of employees in 2009 with no attrition.



If there was 25% increase in the employee strength of the company in 2009 with no attrition, what is the difference between employees at location A in 2008 and employees at location in F in 2009? _____

39. In an election, if no single candidate secures a simple majority of 50% in the first round, then the top five candidates in terms of voles polled proceed to the next round. If no one still get a simple majority, then the top three of that round go into the next round. If the decision is still not decisive in favour of one candidate, only the top two proceed to the last round. The pie charts show the result of the elections. The law states that every candidate other than the top five candidates in Round 1 must pay ₹ 20 for every vote less than the votes of the lowest of top five. How much will the government earn through this source?

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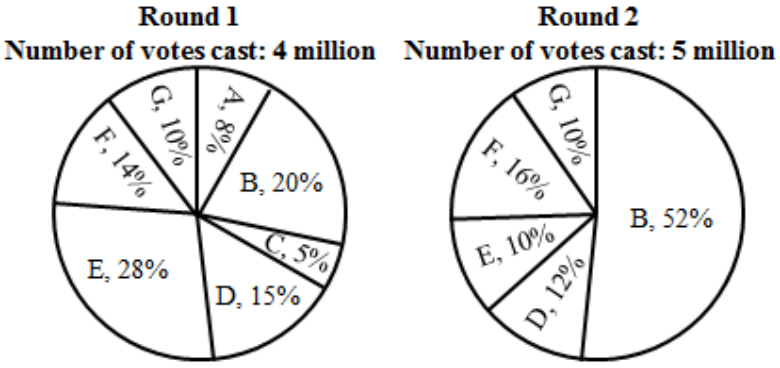
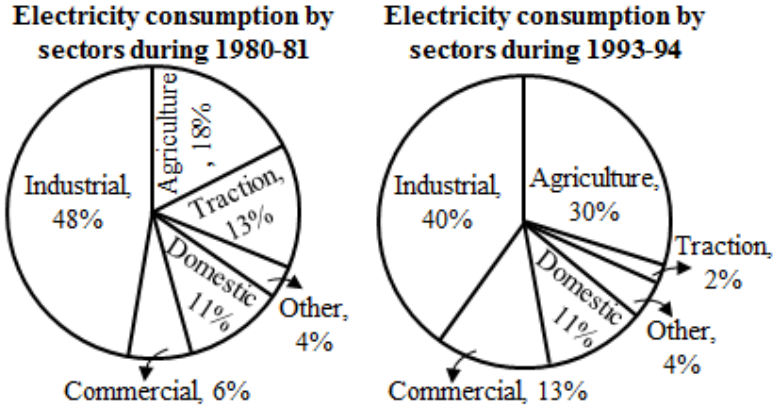


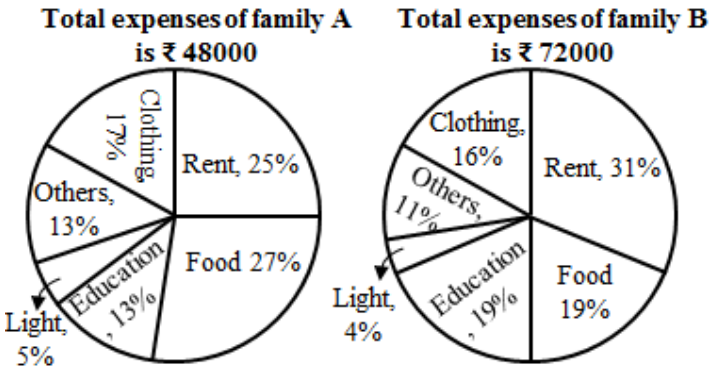
(a) ₹ 5.6 million (b) ₹ 6 million (c) ₹ 56 million (d) ₹ 28 million

40. The electricity consumption by various sectors during 1980-81 and 1993-94 is given in the following pie charts.

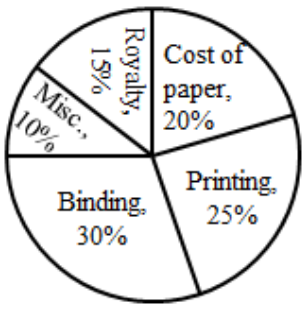


If the total electricity consumption in 1993-94 is 1.2 rimes of the total electricity consumption in 1980-1981, then how many sectors have definitely increased by more than 50% during the same period? _____

41. The two pie charts given below provide the expenses of two families. If family A and family B decide to combine their expenses, then which one of the following heads will be responsible for the highest expense?
(a) Rent
(b) Food
(c) Others
(d) Education



42. In the following pie chart which represents the cost of various parameter in book publishing, the marked price of the book is 20% more than the cost price. If the marked price of the book is ₹ 30 then what is the cost (in ₹) of the paper used in a single copy of the book? _____



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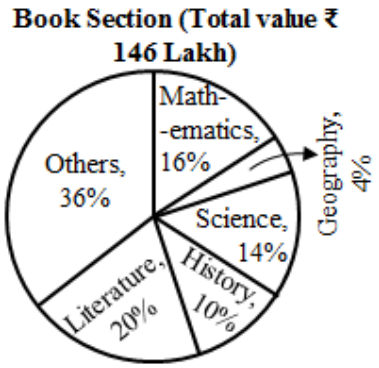
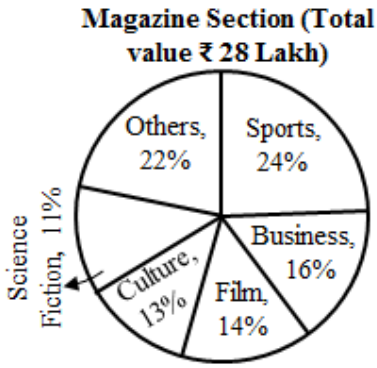
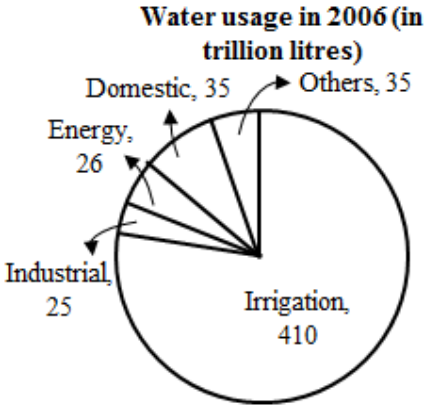
43. The given two pie charts gives the data about book in the library. Based on the data given, which of the following statement(s) is/are correct?

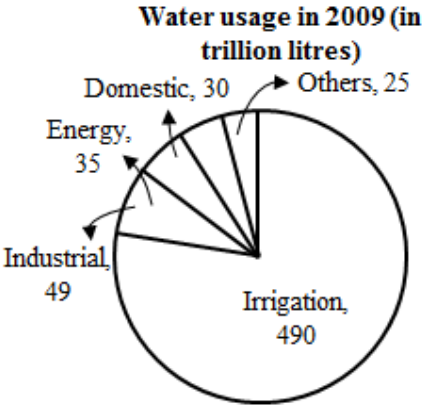




(a) Literature, Mathematics and Science group comprise nearly 50% of the book section
(b) Sports, Business and Film accounts for more than half of the magazines
(c) The value of sports magazines is higher than that of Geography books
(d) None of these

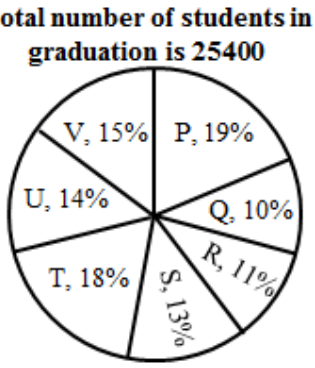
44. The given two pie charts represent the shift in water usage between 2006 and 2009.

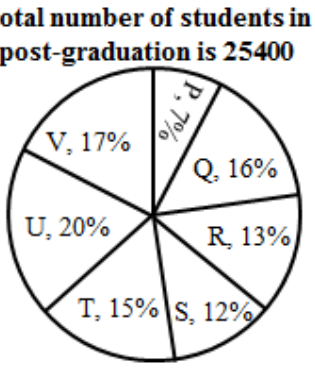




If the ratio of processing cost for water for industrial, energy and domestic usage is 3 : 5 : 2, what is the ratio of processing cost for above mentioned usage in 2006 to that in 2009?
(a) 0.68 : 1 (b) 0.72 : 1 (c) 0.60 : 1 (d) 0.77 : 1

45. The distribution of graduation and post-graduation students in seven institutes is shown in given pie chart. What is the nearest ratio between the numbers of students studying at post-graduation level in institute U and graduation level in institute T?
(a) 6 : 7 (b) 8 : 9
(c) 4 : 5 (d) 3 : 4





46. The expenditures of major categories of a company is given in the following pie chart. The total expenditure in 2001 is ₹ 355 crore and in 2004 is ₹ 560 crore. The amount spent in 2004 on advertising is approximately equal to the amount spent on which of the following?
(i) Salaries in 2001
(ii) Advertising, R & D and technical fees in 2001
(iii) One third of salaries, R & D and taxes in 2004.

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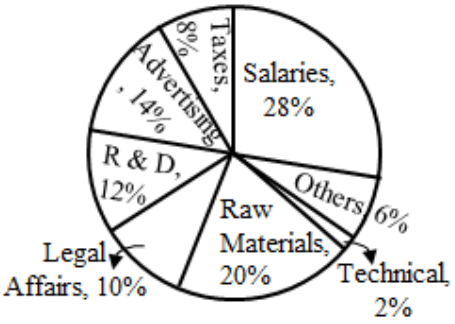
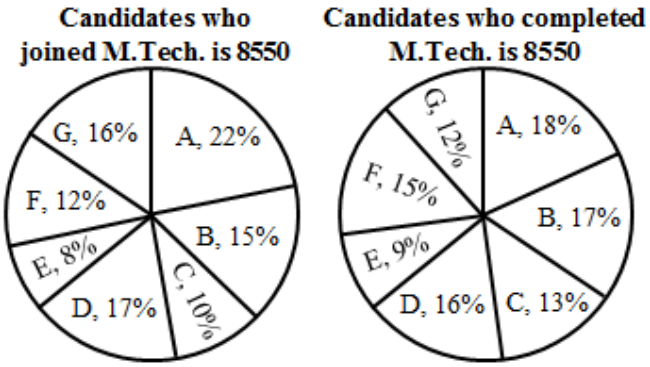


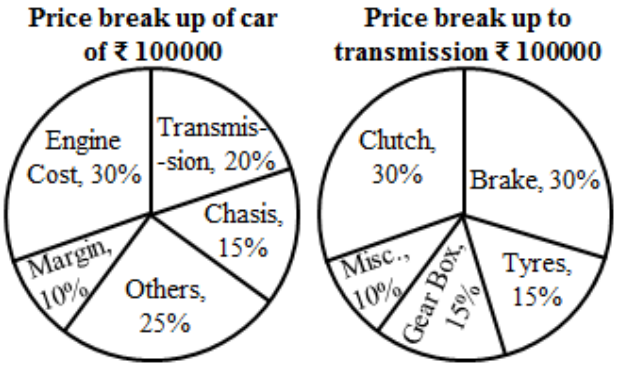
(a) (i) and (ii) only (b) (i), (ii) and (iii) (c) (i) only (d) None of the above

47. The distribution of candidates who joined M.Tech. Programme and successfully completed from seven institutes is given in following pie charts. Which institute has the highest percentage of candidates who completed the M.Tech. Programme out of the candidates that joined?

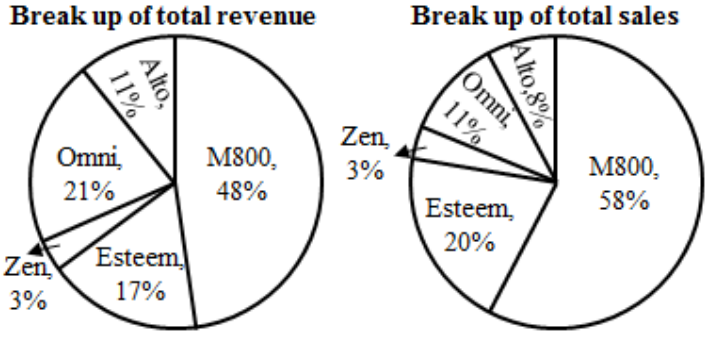


(a) C (b) B
(c) F (d) E

48. The following pie charts gives the price break up of components of a car. If transmission cost increases by 10% and engine cost increases by 20%. What is the percentage contribution of transmission to the cost? _____



49. The pie charts below show the break-up of the total revenue and total sales volume for a company, for the year ended 2003. Total revenue is ₹ 1139200 million and total saler volume is 653610 units.



Based on the data given above, the highest net revenue per vehicle comes from
(a) M 800 (b) Omni (c) Esteem (d) Zen

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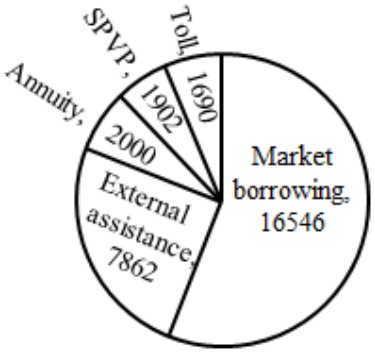
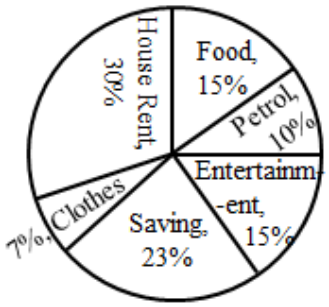
50. The pie chart given below shows the funding arrangements for National Highways development projects – phase 1. The total cost of the project is ₹ 30000 crores. Based on the data given in pie chart, near about 25% of the funding arrangement is though

(a) External assistance
(b) Market borrowing
(c) Annuity
(d) SPVP

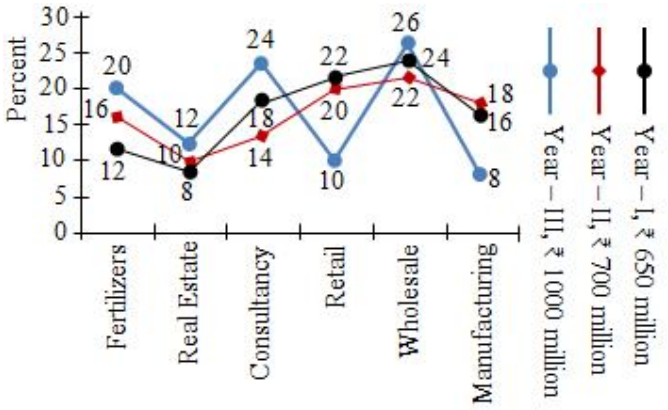


51. The following pie chart shows the distribution of a person's monthly annual over a different expense heads. The angle (in degrees) made at the centre of the pie chart by sector representing the expense on petrol is, _____.

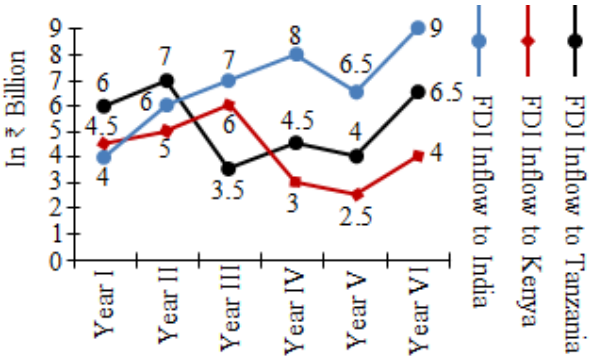


52. The following line graph shows Corporate Social Responsibility spending for the arts promotion by sectors in three years. Based on the data given in line graph, from Year II to Year III the percentage (in %) increase is minimum for which sector?

(a) Wholesale
(b) Consultancy
(c) Manufacturing
(d) Fertilizer



53. The following line graph shows the FDI inflows to India, Kenya and Tanzania in ₹. Based on the data given in line graph, average annual percentage growth rate in the FDI inflows to India is what percentage (in %) greater than average annual percentage growth rate in the FDI inflows to Kenya during the Year I to Year III?



54. The given line graph indicates the amount of money raised through various financial instruments from capital market by a company. The amount is in ₹ crores. Based on the data given in above graph, the amount of private placement raised as a percentage of total funds raised was the maximum in the year

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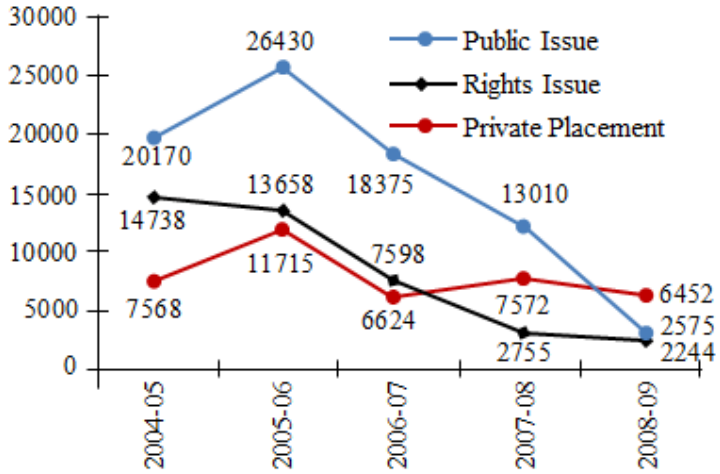
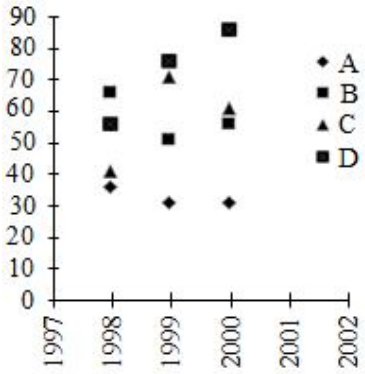
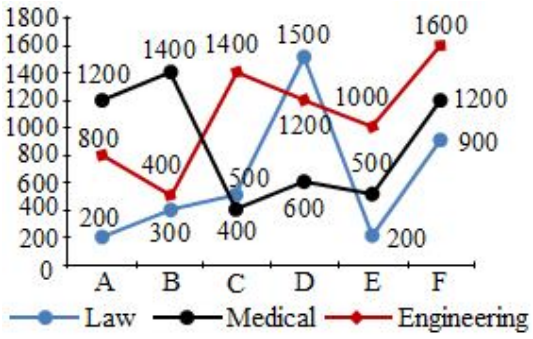


(a) 2004-05 (b) 2007-08 (c) 2005-06 (d) 2008-09

55. The scatter diagram shows the number of students passing in intermediate examination in the given years from four schools. If the trend observed between 1999 and 2000 continues in the next year, what will be number of students passing the examination in 2001? _____

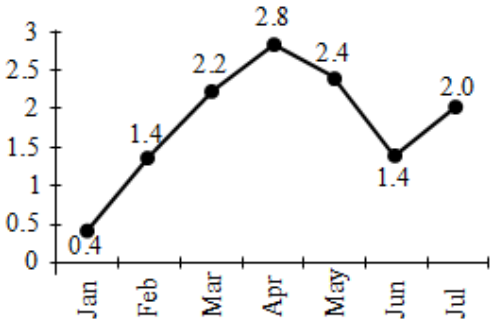


56. The following line graph shows the number of successful candidates from different schools (A to F) in different disciplines. Based on the data given in above line graph, the total number of successful candidates from Medical discipline is approximately what percentage (in %) that from Law? _____



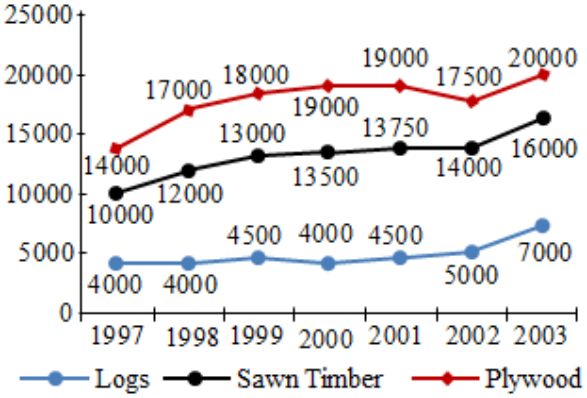
57. The following line graph represents the rainfall in inches during the month of January to July in a particular year in a city. Based on the data given in above line graph, the ratio of rainfall between the months February and July is

(a) 2 : 3
(b) 3 : 2
(c) 7 : 10
(d) 3 : 10



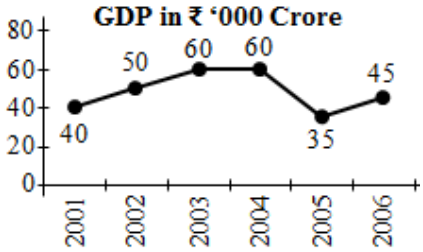
58. The line graph for timber product prices is shown below, where the prices of timber are given for the period 1997-2003. The prices for plywood and sawn timber are given in ₹/m3 while the

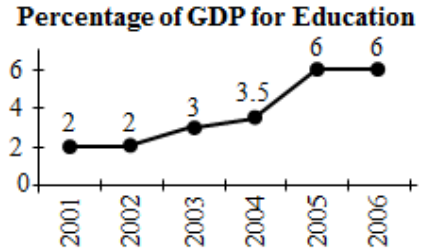
price of logs is given in ₹/tonne. Assume 1 tonne is equal to 1000 kg and one cubic metre of log weighs 800 kg. Which product has the largest percentage increase in price per cubic metre over the seven year period?



(a) Sawn timber (b) Logs (c) Plywood (d) Data insufficient

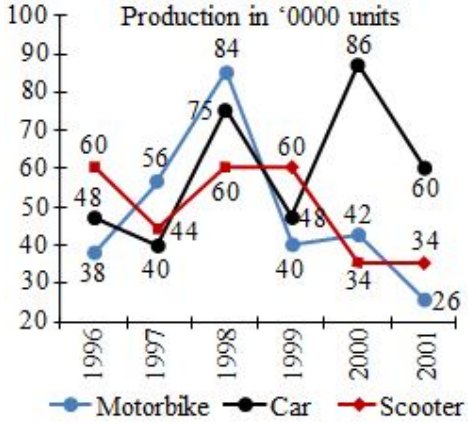
59. The following two line graphs gives the information about GDP and the percentage of GDP in education for our country.

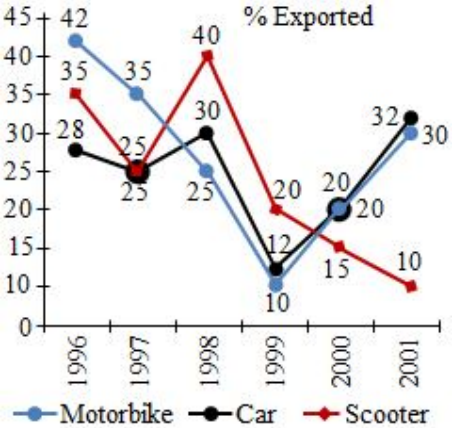




In how many years has actual educational spending reduced as compared to that of the previous year? _____

60. The following line graphs which shows the production (in 0000 units) and percentage exported of scooter, motorbikes and car respectively over the years.





Based on the data given in above line graphs we can conclude that,

I. In the year _____ the production of cars is more than 50% of the production.

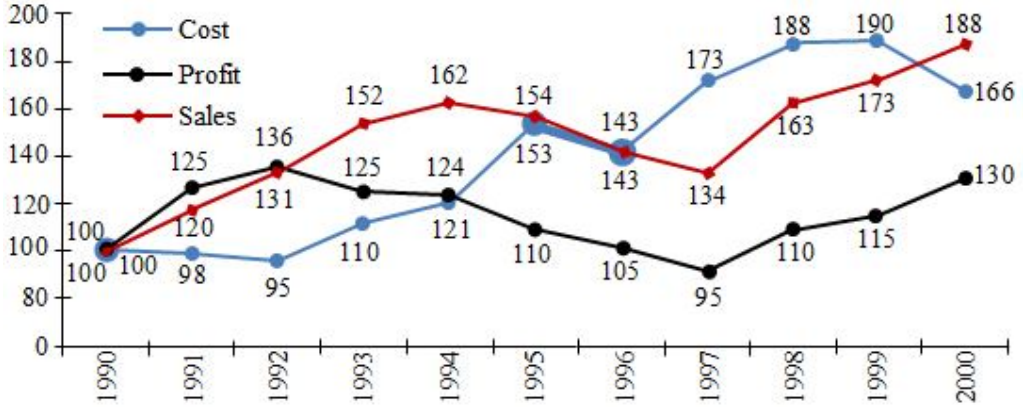
II. If the ratio export prices of a cars, scooter and motorbike was 2 : 1 : 1.5 in 1998, then the proportion of their export earning is in the ratio of _____.

(a) 2000, 45 : 24 : 31.5 (b) 2001, 4 : 2 : 3

(c) 2000, 4 : 2 : 3 (d) 2001, 45 : 24 : 31.5

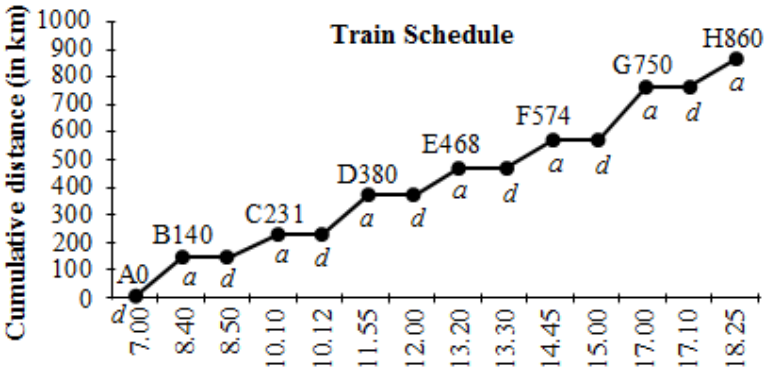
61. The following line graph represents the index of sales, cost and profit. If is to be noted that,

Profit = Sales – Cost – Tax; and Gross profit = sales – cost.



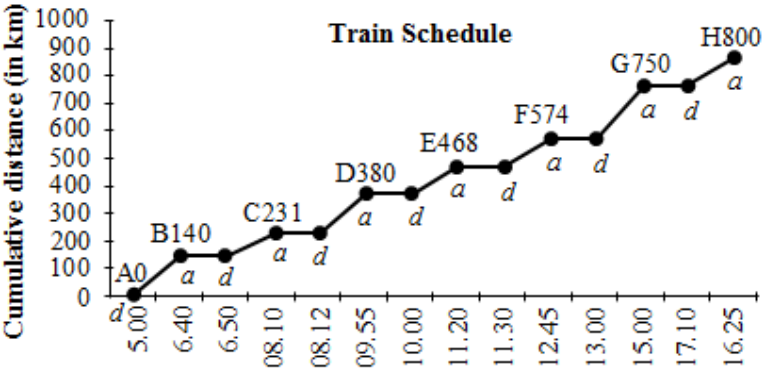
Based on the data given in above line graph, what was the difference (approx.) between the average sales index and the average cost index? _____

62. The line graph shown below gives the data about a train which runs through cities A, B, C, D, E, F, G and H. The line graph indicates the time schedule of the train including times of arrival (*a*) and departure (*d*).



Based on the data given above in line graph, the overall average speed (in km/h) of the entire trip excluding stoppage time is nearly _____.

63. The line graph shown below gives the data about a train which runs through cities A, B, C, D, E, F, G and H. The line graph indicates the time schedule of the train including times of arrival (*a*) and departure (*d*).



Between how many pairs of consecutive stations does the speed run below the overall average speed of the entire trip? _____.

64. The pie chart shows sources of income for an NGO. The total income is ₹ 40 crore. The bar chart gives the expenditure incurred on various items: A – Food for poor; B – Education of illiterate; C – Mid day meal programme; E – Eye camp expenses; F – Integrated street children programme. Total expenditure is ₹ 39 crore. Suppose in a particular year, grant from Central Government increases by 10%, foreign contribution decrease by 10% and other income amounts remain same.

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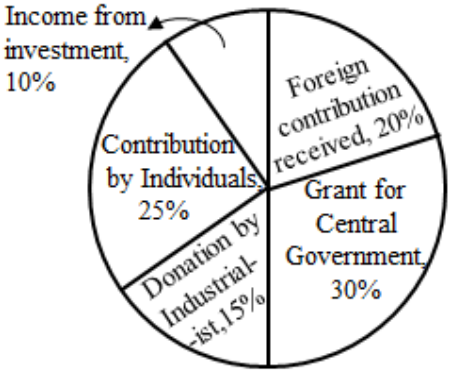
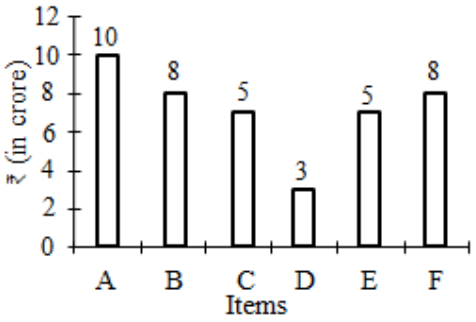
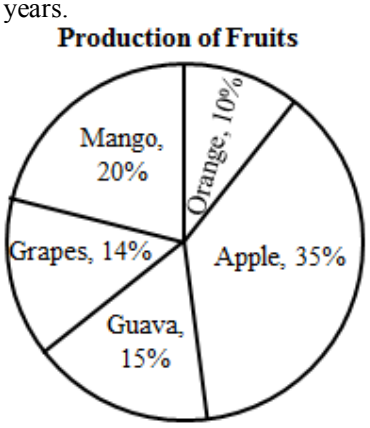
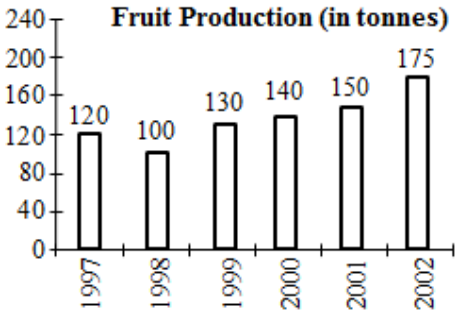

Income from investment, 10%
Foreign contribution received, 20%
Contribution by Individuals, 25%
Grant for Central Government, 30%
Donation by Industrial-ist, 15%



If the expenses pattern remains same, what is the percentage (in %) increase in 'Food for poor' sector? _____

65. The following bar chart depicts the production of fruits in Haryana state over the years and the pie chart represents the percentage of different fruits. The percentage of fruits remains same for all the years.

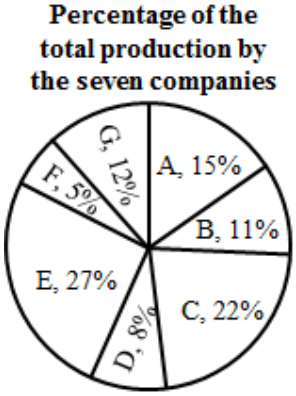




Based on the given in above charts, if half of the grapes produced in 1998 was exported and the total revenue generated from it was approx. ₹ 1.4 lakh, what was the price per tonne (in ₹ '000) at which grapes were exported? _____

66. Seven companies A, B, C, D, E, F, and G are engaged in production of two items I and II.

Company	Ratio of production		Percentage Profit	
	Item I	Item II	Item I	Item II
A	2	3	25	20
B	3	2	32	35
C	4	1	20	22
D	3	5	15	25
E	5	3	28	30
F	1	4	35	25
G	1	2	30	24

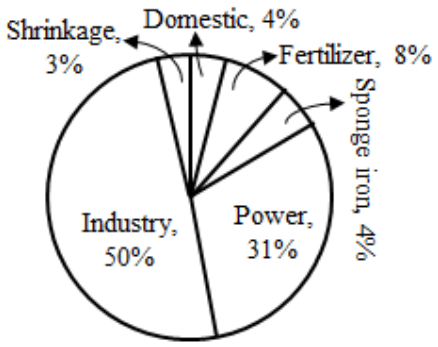


The comparative data about production of these items by the seven companies is given in the following pie chart and table. Based on the data given in above charts, if the cost of total production (both items together) by seven companies is ₹ 25 crore, what is the total cost of the production of item I by companies A and C together in ₹ crore? _____

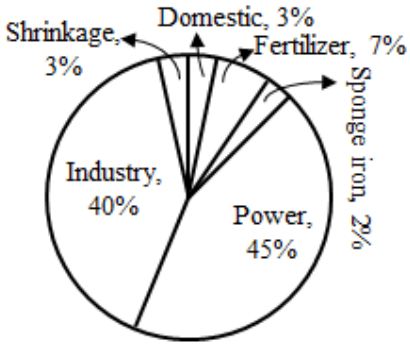
67. The following gives the demand for gas in million metric standard cubic metres per day; and the pie chart gives the sector-wise share from year 1999-2000 and 2004-2005.

Region	Year 1999-2000	Year 2004-2005
North	49.48	64.81
West	37.00	78.13
South	39.90	88.31
East	20.16	52.65
Total	146.54	283.90

Sector wise share: 1999-2000



Sector wise share: 2004-2005



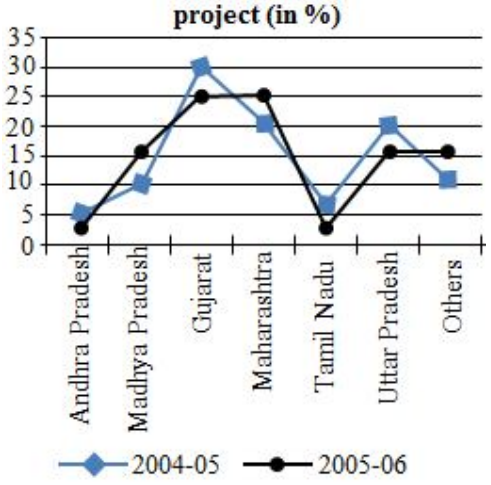
Based on the data given in table and pie charts, what is the percentage (in %) growth in all India demand for Industry sector between 1999-2000 and 2004-2005? _____

68. The state-wise break-up of new projects in various states is given in the following table. The state-wise break-up of outlay for new projects (in %) is given in line graph.

	2004-2005	**2005-2006**
Maharashtra	20	20
Uttar Pradesh	15	20
Gujarat	10	12
Madhya Pradesh	4	3
Andhra Pradesh	3	2
Tamil Nadu	4	1
Others	20	25

Based on the data given in table and line graph, in how many states (not counting those categorised as 'Others') did the outlay per project decline? Assume there is no change in total project outlay. _____

State-wise data of outlay for new project (in %)



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Answer Keys

Answer Keys: Exercise: 12.1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
c	d	0.6	d	b	a	d	b	a	d	a	c	a	d	d
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
d	b	60	c	c	2	2	d	b	0.45	d	a	2.88	b	d
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
b	b	c	c	a	300	a	9675	d	2	a	5	d	b	c
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
d	a	22.44	b	a	36	c	125	d	255	43.24	c	b	0	a
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**							
7.5	81	2	1	20	9.25	55	2							

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Chapter 13 : Data Sufficiency

Data sufficiency questions consist of a question followed by some statements. We have to decide which of the given statements are sufficient to answer the asked question. The topics on which the questions asked are already covered in previous chapters. The questions that were asked in previous year GATE examination were already solved in respective previous chapters. The exercise on data sufficiency is given as:

Exercise 13.1

In all the following questions, a data is given along with some statements. You have to decide which statement(s) is are required to solve the question and choose one from the following option as:

(a) If only Statement I alone is sufficient to answer the question.
(b) If only Statement II alone is sufficient to answer the question.
(c) If both Statements I and II are required to answer the question.
(d) If both Statements I and II together are not sufficient to answer the question.
(e) If either Statements I or II is sufficient to answer the question.

1.	There were 90 students to be interviewed for selection to a computer course. To finish the interview in one day three panels X, Y and Z were formed. How many students are interviewed by Panel X? **I.** The three panels on an average interview 30 students. **II.** The number of students interviewed by Panel X is more by 4 than the students interviewed by Panel Z. The number of students interviewed by Panel Y is more by 2 than the students interviewed by Panel Z.
2.	A, B, C and D are four numbers. What is the standard deviation of these four numbers? **I.** The sum of squares of A, B, C and D is 360. **II.** The sum of A, B, C and D is 36.
3.	Amongst five students A, B, C, D, E. who got the maximum marks? **I.** D got more than A and C. **II.** B got less than E but more than D.
4.	In a class, 150 students took the examination of Physics and Chemistry, 90 students passed in Chemistry and 50 passed in physics. How many 41 students passed in both? **I.** Overall 30 students failed in both the papers **II.** Physics paper was tougher than Chemistry paper
5.	x, y and z are integers. Is x an odd number? I. An odd number is obtained when x is divided by 5. II. $(x+y)$ is an odd number.
6.	P, Q, R and S are four consecutive even integers. What is the value of the largest integer among these? **I.** The average of the four numbers is the first prime number greater than 10. **II.** The ratio between the largest and the smallest of the number is less than 10?
7.	Is $\lvert x\rvert < 1$ If $x \neq 0$? **I.** $x^2 < 1$ **II.** $\lvert x\rvert < 1/x$
8.	If k^2 an integer? **I.** k is a negative whole number **II.** $4k^2$ is an integer
9.	Find three positive consecutive even numbers. **I.** The average of four consecutive even numbers starting from the last of the given numbers is 17 **II.** The difference of the highest and the lowest number is 4
10.	In a two-digit number, the digit at unit's place is 4 more than the digit at the ten's place. Find the two-digit number. **I.** Sum of their digits is 10

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	II. The difference between the number and the number obtained by interchanging the positions of the digits is 36
11.	Which newspaper has the maximum circulation in Delhi? **I.** 2 lakh copies of newspaper X is sold in Delhi while the circulation of newspaper Y is estimated at 3 lakh. **II.** The circulation of newspaper Y is 55% of the total circulation of newspapers.
12.	If there is an average of 250 words on each page, how many pages can Michael read in an hour? **I.** There is an average of 25 ten-word lines on each page. **II.** Michael can read 30 ten-word lines per minutes.
13.	If $x > 0$, is $x > 2$? **I.** $2 > 1/x$ **II.** $-1/x > -1$
14.	x, y, z are integers. Is y an even number? **I.** $(x+y)$ is an odd number **II.** $(y+z)$ is an odd number
15.	If x, y, z are even integers and $2 < x < y < z$, then what is the value of y? **I.** $z < 10$ **II.** $x < 6$
16.	If x and y are integers lies in $[10, 99]$, is $(x-y)/9$ an integer? **I.** x and y have same digits, but in reverse order. **II.** The ten's digit of x is 2 more than the units digit, and the tens digit of y is 2 less than the unit digit.
17.	Is $x > y$? **I.** $y > 0$ **II.** $x/y > 1$
18.	Is $p = m$? p, m are real numbers. **I.** $p^2 = m^2$ **II.** $p^3 = m^3$
19.	A number k is added to the numerator and denominator of a fraction a/b. Will the value of fraction increase? **I.** a/b is a proper fraction **II.** a, b, k are all positive integers
20.	If n is an integer, then n is divisible by how many positive integers? **I.** n is the product of two different prime numbers. **II.** n and 2^3 are each divisible by the same number of positive integers
21.	Is $x^3 = 125$? **I.** $x > 4$ **II.** $x < 6$
22.	Is $a - b > 0$? **I.** $a > b$ **II.** $a^2 > b^2$
23.	Is $x - y > p - q$? **I.** $x > p$ and $y < q$ **II.** $y = 2$, $q = 3$, $p = 5$ and $x = 6$
24.	How many marks did Anita get in History? **I.** Average marks obtained by Anita in History, Maths and English is equal to the average marks in Maths and English. **II.** Anita got a total of 120 in Maths and English together.
25.	$x, y > 0$. Is $2^x > 3^y$? **I.** $x > 2y$ **II.** $x \geq y + 3$
26.	What is the value of $k^2 - 2k$? **I.** $k - 1/k = 2$ **II.** $2k - 1 = \sqrt{5}$
27.	Are the integers p, q, r are consecutives? **I.** The average of p, q and r is q **II.** $q - p = r - q$
28.	If $x^6 - y^6 = 0$, what is the value of $x^3 - y^3$?

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	I. $x > 0$	**II.** $y > 1$
29.	If $y = 2^{x+1}$, what is the value of $x - y$?	
	I. $2^{2x+2} = 64$	**II.** $y = 2^{2x-1}$
30.	Find the value of x, if $x + 2y = 6$.	
	I. $2x + y = 9$	**II.** $3x + 2y = 14$
31.	A vendor sells begs of mango for ₹ 200, bags of grapes for ₹ 400 and bags of apples for ₹ 500. How many bags of apples did the vender sell?	
	I. The vendor sold one bag of mango.	
	II. In total, the vendor sold 7 bags of fruits for ₹ 3300.	
32.	A loaf of bread costs ₹ 120. How much would a similar loaf cost?	
	I. The similar loaf has dimension one-fifth of the original	
	II. The weight of original loaf of cake is 200 g.	
33.	An area is under construction and has two varieties of flats, HIG and MIG types. 70% of the flats are MIG type. The number of finished HIG flats is twice the number of unfinished MIG flats. What percentage of flats in that area is finished?	
	I. The number of finished HIG flats is five times the number of unfinished HIG flats.	
	II. An area has a total of 300 HIG and MIG flats.	
34.	A person invested his saving in term deposit of three different limited companies. If the average size of 3 term deposits is ₹ 3 lakh, is the smallest account less than ₹ 2.5 lakh.	
	I. The highest term deposit is ₹ 3.9 lakh.	
	II. There are two more term deposits other than the highest term deposit. One of the two term deposits is ₹ 2.1 lakh.	
35.	John makes seven deposits in his bank account. What was his total deposit?	
	I. The largest deposit was ₹ 2500 and the smallest was ₹ 270.	
	II. The average deposit was ₹ 1250	
36.	Find the ratio of $(x + z) : z$.	
	I. $x : z = 2 : 7$	**II.** $y : z = 3 : 2$
37.	What will be the compound interest on a sum after 3 years?	
	I. The compound interest on the sum at 5 er annum for 2 years is ₹ 12.50 more than the simple interest.	
	II. The difference between compound interest and simple interest on the sum for 3 years at 5% per annum is ₹ 38.125	
38.	What is the percentage profit on selling of 12 dozens of toys?	
	I. Toys were bought at ₹ 12 per dozen and sold in a lot of 4 numbers for ₹ 4.	
	II. The mark-up on toys is 12%.	
39.	What is the cost of a book?	
	I. The selling price is 25% more than the cost price.	
	II. The seller makes a profit of ₹ 100 on selling every lot of 5 books.	
40.	In a queue for railway tickets, 5 persons Ram, Shyam, Narendra, Naresh and Ramesh are standing in random order. Who is the 3rd person in the queue?	
	I. Shyam is standing behind Ram and Narendra is ahead of Ram.	
	II. The queue starts from Ramesh and ends with Naresh.	
41.	By selling a product for ₹ 100, how much profit was earned?	
	I. 20% profit would have been earned if it has been sold for ₹ 90.	
	II. The profit was one-third of the purchase price.	
42.	What will be the mother's age after 15 years?	
	I. The ratio between the ages of the mother and the daughter at present is $5 : 1$	
	II. After 10 years, daughter will be 25 years younger than her mother.	
43.	Ravi gets ₹ 432.10 as compound interest by investing some money. What is the rate of interest?	
	I. Interest was for four years.	
	II. For the same period, simple interest was ₹ 400 at the same rate.	

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44. What is the average daily wages of a worker who works five days; he made ₹ 80 the first day?
- **I.** The worker made a total of ₹ 400 for the first four day of work.
- **II.** The worker made 20% more each day than he did on the previous day.

45. In a class, the ratio of boys and girls is 13 : 10 . How many boys are there in the class?
- **I.** The number of boys is 30% more than that of girls.
- **II.** The number of girls is 15 less than that of boys

46. What is the speed of running train which takes 6 seconds to cross a signal post?
- **I.** The length of the train is 90 m
- **II.** The train takes 18 seconds to cross a platform 180 m long.

47. What is the rate of CI on a sum of money?
- **I.** The difference between CI and SI at the same rate of interest for 2 years is ₹ 43.20 and SI at the end of 5 years is ₹ 3600.
- **II.** The difference between CI and SI at the same rate of interest on ₹ 12000 for 3 years is ₹ 132.19

48. How much minimum marks are required to pass an examination?
- **I.** Student I secured 38% marks in the examination and failed by 8 marks. Student II secured 42% marks in the same examination and got 12 more than the minimum pass marks.
- **II.** Student I secured 35% of the total marks in the examination and failed by 23 marks. If he had secured 25 more marks, his percentage of marks would have been 40%.

49. 15 men and 20 women work together for 5 days and then 5 mend and 8 women leave the group. In how many days will the remaining work be finished by the remaining people?
- **I.** The work done by 1 man is equal to the work done by 2 women.
- **II.** 20 men alone can do the entire work in 15 days.

50. A 25 m long wire is cut into 3 pieces. How long is the longest piece?
- **I.** Two pieces of the wire are of the same length.
- **II.** The longest piece of the wire is 12.5% more than the smallest piece.

51. Sonu's income is how much more than Monu's?
- **I.** Sonu's income is 30% less than her husband's whose provident fund deduction at the rate of 5% is ₹ 975 per month.
- **II.** Monu spends 30% of her income on house rent, 15% of which is electricity bill.

52. Find out the share of B out of the combined share of A, B and C of ₹ 946.
- **I.** The share of A is $2/9$ of the combined share of B and C.
- **II.** The share of B is $3/19$ of the combined share of A and C.

53. Mohan is 6 years older than Sohan. What will be the sum of their present ages?
- **I.** After 6 years, the ratio of their ages will be 6 : 5
- **II.** The ratio of their present ages is 5 : 4

54. What is the average speed of Amit during his three hours of trip?
- **I.** He travelled a total of 120 km.
- **II.** He travelled half the distance at 30 km/h and half the distance at 60 km/h.

55. Are of at least 20% of the people in a town who are 30 years old or older bilingual?
- **I.** In a town, 30% of the population is at least 30 years old.
- **II.** In a town, of the population 30 years old or older, 18% of the women and 17% of the men are bilingual

56. What selling price should be marked on the article?
- **I.** Discount of 5% is to given and profit percentage should be double the discount. Purchase cost is in the range of ₹ 300 - ₹ 400.
- **II.** 10% discount is to be allowed and 15% profit is to be obtained on the purchase cost of ₹ 200 of the article.

57. How many families in a city own exactly two cars?
- **I.** 150 families in a city own at least one car.
- **II.** 45 families in a city own at least three cars.

58. What percentage of families in a city have monthly income of ₹ 25000 and own a house?

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	I. 28% of all the families in a city have monthly income of ₹ 25000 and own a house. **II.** 40% of all the families in the city with the monthly income of ₹ 25000 own a house.
59.	What is the ratio of boys to girls admitted into an engineering college? **I.** The number of girls admitted is two-fifth of the number of boys admitted. **II.** The number of girls admitted is 3 less than half the number of boys admitted.
60.	Neha had an average score of 85 in three tests. What was the Neha's lowest score? **I.** The average of Neha's two highest score was 92. **II.** Neha's highest score was 95
61.	If the playground is rectangular in shape then what is its width? **I.** The ratio of its length to its width is $7:2$. **II.** The perimeter of the playground is 396 m.
62.	Is Varsha is taller than Jonny? **I.** Varsha is taller than Amit **II.** Amit is not as tall as Jonny
63.	In a parallelogram PQRS, what is the $\angle PSR$? **I.** $\angle PQR > 90^o$ **II.** $\angle QRS = 70^o$
64.	What was Amit's average driving speed in km/h during 15 minutes duration? **I.** He drove 10 km during this interval. **II.** His maximum and minimum speed was 50 and 35 km/h, respectively, during this interval.
65.	In ΔABC, if $\angle A = 30^o$, $\angle C = 60^o$, then what is the length of AC? **I.** $AC = 10$ **II.** $BC = 10$
66.	Bhavesh took three times as long to drive from home to work as it took Simran to drive from home to work. How many km did Bhavesh drive from home to work? **I.** Simran drove 10 km from home to work, and the ratio of distance driven from home to work time to drive from home to work was the same for Bhavesh and Simran that day. **II.** The ratio of distance driven from home to work time to drive from home to work for Simran that day was 64 km/h.
67.	A circular shape of maximum area is cut from a square. What is the remaining area of the square? **I.** The area of square is 9 sq. units. **II.** The area of circular shape is 3π sq. units.
68.	Is quadrilateral P a square? **I.** The sides of P have the same length **II.** The diagonals of P have the same length
69.	The surface area of a square table-top was changed so that one of the dimensions was reduced by 1 m and the other dimension was increased by 2 m. What was the surface area before these changes were made? **I.** After the changes were made, the surface area was 70 m^2. **II.** There was a 25% increase in one of the dimensions.
70.	What is the average distance that a car travels on one full tank of petrol? **I.** Car's average is 8.5 km/litre of petrol. **II.** The petrol tank of a car holds exactly 40 litres of petrol.
71.	If p, q, r are three lines in a plane, is line p perpendicular to line r? **I.** p is perpendicular to q **II.** q is perpendicular to r
72.	A rectangular open land 4 m wide is to be completely covered with non-overlapping square bricks, each with side of length 0.25 m, with no portion of any brick remaining. What is the least number of such bricks that will be required? **I.** The length of the floor is three times the width. **II.** The area of the floor is 48 square meters.
73.	In a triangle ABC, BD is a line, where D is a point on side AC. Is triangle ABC isosceles? **I.** The area of triangular region ABD is equal to the area of triangular region DBC. **II.** BD and AC are perpendicular; $AD = CD$
74.	Each person on a committee with 40 members voted for exactly one of 3 candidates, A, B, or

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C. Did Candidate A receive the most votes from the 40 votes cast?
I. Candidate A received 11 of the votes **II.** Candidate C received 14 of the votes

75. If the area of triangular region ABC is 25, what is the perimeter of ABC?
I. The length of one side of ABC is $5\sqrt{2}$ **II.** RST is a right isosceles triangle

76. The table above gives the number of calories and grams of protein per kilogram of foods A and B. If a total of 7 kilograms of A and B are combined to make a certain food mixture, how many kilograms of food A are in the mixture?
I. The mixture has a total of 12,000 calories
II. The mixture has a total of 810 grams of protein

Food	No. of calories/kg	No. of gm/kg
A	2000	150
B	1500	90

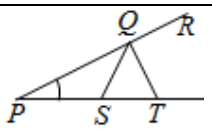
77. If $A = \{2, 3, x, y\}$, what is the value of $x + y$?
I. x, y are prime numbers
II. $3, x, y$ are consecutive odd numbers in ascending order

78. In triangle ABC, what is the length of AC?
I. AB is 5 cm **II.** BC is 8 cm

79. If Rajeev began a job and worked continuously until he finished, at what time of day did he finish the job?
I. He started the job at 8:15 a.m. and at noon of the same day he had worked exactly half of the time that it took her to do the whole job.
II. He was finished exactly after 7.5 hours after he had started.

80. If a rectangle is inscribed in a circle, what is the radius of the circle?
I. The length of the rectangle is $\sqrt{3}$ and the width of the rectangle is 1.
II. The length of larger side of rectangle is one-third of the circumference of the circle.

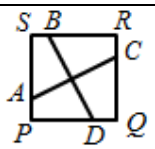
81. In the figure shown, line PR represents a seesaw that is touching level ground at point P. If Q is the midpoint of PR, how far above the ground is point R?



I. $\angle QPS = 30^o$ **II.** Point Q is 5 feet above the ground

82. Kavita put 12 cards on a table, some face-up and the rest face-down. How many were put facedown?
I. Kavita put an even number of the cards face-up
II. Kavita put twice as many of the cards face-up as she put facedown.

83. The figure shown is a square PQRS, which is formed by joining the four tiles. Is AC = BD ?
I. SB = RC = QD = PA
II. The perimeter of PQRS is 16



84. What is the rate, in m^3/min, at which water is flowing into a certain rectangular tank?
I. The height of the water in the tank is increasing at the rate of 2 m/min.
II. The capacity of the tank is 216 m^3.

85. What is the volume of a cube?
I. The total surface area of the cube is 54.
II. The greatest possible distance between two points on the cube is $3\sqrt{3}$.

86. Parul and Ekta are in a line to purchase tickets. How many people are in the line?
I. There are 20 people behind Parul and 20 people in front of Ekta.
II. There are 5 people between Parul and Ekta.

87. A certain organisation currently has how many employees?
I. If 3 additional employees are hired by the organisation and all of the present employees remain, there will be at least 20 employees in the organisation.
II. If no additional employees are hired by the organisation and 3 of the present employees resign, there will be fewer than 15 employees in the organisation.

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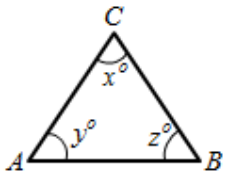
88. What is the value of z in triangle ABC?

I. $x + y = 139$

II. $y + z = 108$



89. How many km long is the route from A to B?

I. It will take 1 hour less time to travel the entire route at an average rate of 55 km/h than at an average rate of 50 km/h.

II. It will take 11 hours to travel the first half of the route at an average rate of 25 km/h.

90. If p, q, r and s are non-zero numbers, is $(a-1)(b-2)^2(c-3)^3(d-4)^4 \geq 0$?

I. $b > 2$ and $d > 4$ **II.** $a > 1$ and $c > 3$

91. Renu can drive from her home to her office by one of two possible routes. If she must also return by one of these routes, what is the distance of the shorter route?

I. When she drives from her home to her office by the shorter route and returns by the longer route, she drives a total of 32 km.

II. When she drives both ways from her home to her office and back, by the longer route, she drives a total of 36 km.

92. What is the number of full rotations that a bicycle wheel made while rolling 100 meters in a straight line without slipping?

I. The diameter of the bicycle wheel, including the tire, was 0.5 m.

II. The wheel made twenty full rotations per min.

93. In ΔABC, if $AB = x$, $BC = x + 2$, and $AC = y$, which of the three angles of ΔABC has the greatest degree measure?

I. $y = x + 3$ **II.** $x = 2$

94. If x and y represent the length and width, respectively, of the rectangle, what is the perimeter?

I. $2x + y = 40$ **II.** $x + y = 25$

95. If p, q, and r are three integers, are they consecutive integers?

I. $r - p = 2$ **II.** $p < q < r$

96. In a certain group of people, the average (arithmetic mean) weight of the males is 80 kg and of the females, 60 kg. What is the average weight of the people in the group?

I. The group contains twice as many females as males.

II. The group contains 10 more females than males.

97. If on a fishing trip Ajay and Amit each caught some fish, which one caught more fish?

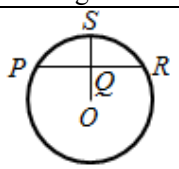
I. Ajay caught two-third as many fishes as Amit.

II. After Amit stopped fishing, Ajay continued fishing until he had caught 12 fish.

98. What is the radius of the circle above with centre O?

I. $OQ : QS = 1 : 2$

II. Q is the mid-point of chord PR



99. A certain 4-liter solution of acid and water consists of x litres of acid and y litres of water. How many litres of acid does the solution contain?

I. $x = 1.5$ **II.** $y = 2.5$

100. Is the perimeter of square greater than the perimeter of equilateral triangle?

I. The ratio of the length of a side of square to the length of a side of equilateral triangle is $4 : 5$.

II. The sum of the lengths of a side of square and a side of equilateral triangle is 18.

101. If x is an integer between 10 and 100, what is the value of x?

I. One of x's digits is 3 more than the other, and the sum of its digits is 9.

II. $x < 50$

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102. If $p+q>0$, is $p>|q|$?

I. $p>q$ **II.** $q<0$

103. If x is an integer, is $(x+p)(x+q)$ an even integer?

I. q is an even integer **II.** p is an even integer

104. Committee member D wants to schedule a one-hour meeting on Sunday for himself and three other committee members, A, B, and C, Is there a one-hour period on Sunday that is open for all four members?

I. On Sunday D and A have an open period from 10 : 00 AM to 1 : 00 PM.

II. On Sunday B has an open period from 11 : 00 AM to 2 : 00 PM and C has an open period from 9 : 00 AM to 12 : 00 noon.

105. How many books were sold at a certain book store today?

I. A total of 100 books were sold at the book store yesterday, 10 fewer than twice the number sold today.

II. The number of books sold at the book store yesterday was 45 more than the number sold today.

106. A certain expressway has exits A, B, C, and D, in that order. What is the road distance from exit B to exit C?

I. The road distance from exit A to exit C is 26 km.

II. The road distance from exit B to exit D is 31 km.

107. Two cars, A and B, each travelled a distance of 50 km. Did car A use more petrol than car B?

I. Cars A and B travelled the entire distance at the rates of 55 km/h and 50 km/h, respectively.

II. For the entire distance, car S travelled 20 km/litre of petrol and car B travelled 25 km/litre of petrol.

108. Each of the eggs in a bowl is dyed red, or green, or blue. If one egg is to be removed at random, what is the probability that the egg will be green?

I. There are 10 red eggs in the bowl.

II. The probability that the egg will be blue is one-third.

109. A bucket can hold a maximum of how many litres of water?

I. The bucket currently contains 10 litres of water.

II. If 3 litres of water are added to the bucket when it is half full of water, the amount of water in the bucket will increase by one-third.

110. If $ab\neq 0$, in what quadrant of the coordinate system does point (a,b) lie?

I. (b,a) lies in fourth quadrant **II.** $(a,-b)$ lies in third quadrant

111. From 1994 to 1997, the value of foreign goods consumed annually in India is increased by what percentage?

I. In 1994 the value of foreign goods consumed constituted 19.8% of the total value of goods consumed in India that year.

II. In 1997 the value of foreign goods consumed constituted 22.7% of the total value of goods consumed in India that year.

112. If x and y are integers and $y=|x+3|+|4-x|$, does $y=7$?

I. $x<4$ **II.** $x>-3$

113. The participants in a race consisted of 3 teams with 3 runners on each team. A team was awarded $(6-n)$ points if one of its runners finished in n^{th} place, where $1\le n\le 5$. If all of the runners finished the race and if there were no ties, was each team awarded at least one point?

I. No pair of teammates finished in consecutive places among the top five places.

II. No team was awarded more than a total of 6 points.

114. Pipes A and B simultaneously fill an empty swimming pool that has a capacity of 50,000 litres. If the flow in each hose is independent of the flow in the other hose, how many hours will it take to fill the pool?

I. Pipe A alone would take 28 hours to fill the pool.

II. Pipe B alone would take 36 hours to fill the pool.

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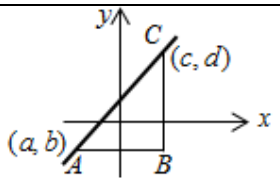
115. In the given figure, segments AB and BC are each parallel to one of the rectangular coordinate axes. Is the ratio of the length of BC to the length of AB equal to 1?



I. $a = -2$, $b = -1$

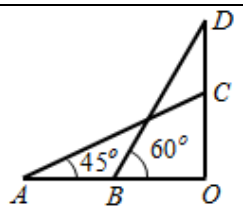
II. $c = 3$, $d = 4$

116. If A and B are each circular regions, what is the radius of the larger of these regions?

I. The area of A plus the area of B is equal to 90π.

II. The larger circular region has a radius that is 3 times the radius of the smaller circular region.

117. In the figure above, segments BD and AC represent two positions of the ladder leaning against the side OD of a wall. The length of AO is how much greater than the length of BO?



I. The length of AC is 10 m

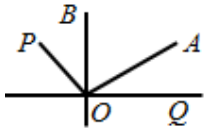
II. The length of BO is 5 m

118. If a certain city is losing 12% of its daily water supply each day because of water-main breaks, what is the cost (in ₹) to the city per day for this loss?

I. The city's daily water supply is 350 million litres.

II. The cost to the city for each 12000 litres of water lost is ₹20.

119. In the figure above, what is the measure of $\angle POQ$?



I. BO bisects $\angle POA$ and OA bisects $\angle BOQ$

II. The measure of $\angle POB = 40^o$

120. The table above shows the distance, in km, by the most direct route, between any two of the four cities, A, B, C, D. What is the value of x?

	A	**B**	**C**	**D**
A	0	y	x	62
B	y	0	56	75
C	x	56	0	60
D	62	75	69	0

I. By the most direct route, the distance between B and C is twice the distance between A and B.

II. By the most direct route, the distance between C and D is 1.5 times the distance between A and C.

121. Tanks A and B contained only water and tank B was half full. If all of the water in tank A was then poured into tank B, what fraction of the capacity of B was then filled with water?

I. Before the water from A was poured, A was one-third full

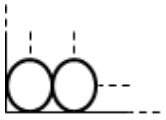
II. Tanks A and B have the same capacity

122. If x is an integer, is y an integer?

I. The arithmetic mean of $x, y, (y-2)$ is x

II. The arithmetic mean of x and y is not an integer

123. The inside of a rectangular carton is 48 cm long, 32 cm wide, and 15 cm high. The carton is filled to capacity with k identical cylindrical cans of fruit that stand upright in rows and columns, as indicated in the figure above. If the cans are 15 cm high, what is the value of k?



I. Each of the cans has a radius of 4 cm.

II. 6 of the cans fit exactly along the length of the carton.

124. Bacteria population doubles every week. How many weeks from now will population first exceed 1000000?

I. The bacteria population is now 65536.

II. Fifteen weeks ago the bacteria population was 2.

125. If no student took Physics test more than once, how many students took Physics test?

I. The average (arithmetic mean) of the students' scores on Physics test was 72

II. The sum of the students' scores on Physics test was 2232.

126. Last year four-fifth of the applicants for a job passed the pre-examination. If three-fourth of

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the applicants who passed the pre-examination also passed the final examination, how many of the applicants passed both examinations?

I. The number of applicants who did not pass either examination was equal to the number who passed the final examination only.

II. There were a total of 100 applicants.

127. If point A is inside a circle with centre O and radius 2 cm, is point B inside the same circle?

I. $OA = 1$ cm **II.** $AB = 2.5$ cm

128. If the measures of' the three interior angles of a triangle are θ_1, $15\theta_2$, and $18\theta_2$, what is the value of θ_1?

I. $\theta_2 = 5^o$ **II.** $\theta_1 + 15\theta_2 = 90^o$

129. How many bags of wheat seeds were used for rectangular field?

I. Field has a perimeter of 720m.

II. One bag of wheat seed was used for each 5000 m^2 of field.

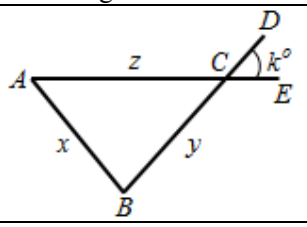
130. There are exactly 6 teams in a cricket match series. What was the total number of games played by the 6 teams?

I. Each team in cricket match series played each of the other teams at least once

II. No team in cricket match series played more than 7 games

131. In the figure, x, y and z denote the lengths of the sides of a triangle ABC. What is the perimeter of the triangle?

I. $x = y = 30$ **II.** $k = 60$



132. If each of the positive integers x, y and z is a prime number and $xyz = 30$, what is the value of z?

I. $x < y < z$ **II.** $x + y = z$

133. Shilpa is in a railway ticket line in which each of the other people in the line is either behind her or ahead of her. In the line, the number of people ahead of Shilpa is 5 more than the number of people behind her. What is the total number of people in the line?

I. There are 11 people ahead of Shilpa in the line

II. The total number of people in the line is 3 times the number of people behind Shilpa.

134. If a line is parallel to one of the axes of rectangular coordinate system, does that line contains the point $(7,8)$?

I. Line contains the point $(7,-8)$ **II.** Line crosses the x-axis

135. If a, b, and n are positive integers, is $(a/b)^n$ greater than 1000?

I. $a = b^3$ and $n > b$ **II.** $a > 5b$ and $n > x$

136. How many hours does it take for 12 workers with same efficiency, working simultaneously without stopping, to complete a work?

I. It takes each worker alone, working continuously, 1 hour to complete a work.

II. It takes 10 of these workers, working simultaneously without stopping, 10 minutes to complete a work.

137. Is line parallel to the $x-$ axis?

I. The equation of line is $y = 4$ **II.** The points $(2,4)$ and $(-5,4)$ are on line

138. In a sequence of numbers in which each term after the first term is 1 more than twice the preceding term, what is the fifth term?

I. The first term is 1 **II.** The sixth term minus the fifth term is 36

139. Is $|x-3| < 7$?

I. $x > 1$ **II.** $x < 10$

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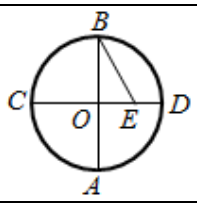
140. In the figure above, what is the area of the circular region with centre O?



I. BA is perpendicular to CD

II. The area of triangular region OBE is 4 sq. units.

141. What is the area of a rectangular surface that has length x m and width y m?

I. y is reciprocal of x

II. The perimeter of rectangular surface is 5 m.

142. What is the greatest common divisor of positive integers x and y?

I. x is a prime number **II.** x and y are consecutive integers

143. Water is pumped into a partially filled tank at a constant rate through an inlet pipe. At the same time, water is pumped out of the tank at a constant rate through an outlet pipe. At what rate, in litres per minute, is the amount of water in the tank increasing?

I. The amount of water initially in the tank is 200 litres

II. Water is pumped into the tank at a rate of 10 litres per minute and out of the tank at a rate of 10 litres every 150 seconds minutes

144. How many people are financers of both films A and B?

I. There were 17 financers present at a joint meeting of the financers of films A and B

II. Film A has 12 financers and film B has 8 financers

145. The length of the edging that surrounds circular track A is half the length of the edging that surrounds circular track B. What is the area of track A? (Assume that the edging has negligible width.)

I. The area of B is 25π m^2 **II.** The edging around B is 10π m^2

146. An employee is 1.5 times the regular hourly rate for each hour worked in excess of 40 hours per week, excluding Saturday, and 2 times the regular hourly rate for each hour worked on Saturday. How much was the employee paid last week?

I. The employee's regular hourly rate is ₹ 10.

II. Last week the employee worked a total of 54 hours but did not work more than 8 hours on any day.

147. If a is an integer, is $a|a| < 2^a$?

I. $a < 0$ **II.** $a = -10$

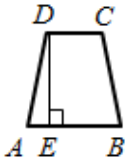
148. If x is a positive integer, is $(1/10)^x < 0.01$?

I. $x > 2$ **II.** $(1/10)^{x-1} < 0.1$

149. If $a < 0$, is $b > 0$?

I. $a/b < 0$ **II.** $b - a > 0$

150. Quadrilateral $ABCD$ shown in which side AB is parallel to side DC (which is 45 m) and AB is longer than DC. $AE = 15$, $DE = 60$ m. What is the area of the quadrilateral?



I. $AB = 80$ m **II.** $BC = 20\sqrt{10}$ m

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Answer Keys

Answer Keys: Exercise: 13.1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
b	c	c	a	a	d	e	a	a	a	d	b	e	d	a
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
e	c	b	c	e	d	a	e	c	a	e	d	d	e	e
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
d	a	c	c	b	a	e	a	c	c	e	d	c	b	b
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
a	e	e	c	c	d	b	e	e	b	b	d	c	a	a
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
c	d	b	a	e	a	e	c	e	c	c	e	b	a	b
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
e	b	d	a	a	b	b	a	d	e	d	c	a	e	b
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
c	a	a	b	c	a	a	d	e	a	c	e	d	c	a
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
d	b	d	b	e	d	c	b	e	c	c	e	c	c	b
121	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**
c	a	e	e	c	b	d	e	d	d	c	e	e	c	b
136	**137**	**138**	**139**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**
e	e	e	c	d	a	b	b	c	e	d	e	e	a	e

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Practice Test Paper – 1

Time: 30 minutes **Max. Marks: 30**

Instructions: This test paper contains question on General Aptitude and Engineering Mathematics. In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

Marking Scheme				
Question Number	**1 to 5**	**6 to 10**	**11 to 15**	**16 to 20**
Mark(s)	**1 mark**	**2 marks**	**1 mark**	**2 marks**

1. Astride is
(a) a verb (b) an adverb (c) a preposition (d) both (b) and (c)

2. Which one of the underlined parts of the given sentence contains an ERROR?
You <u>would have to</u> <u>choose her</u>, if you are <u>looking for the</u> best athlete <u>to represent the school</u>.
I II III IV
(a) I (b) II (c) III (d) IV

3. Choose the correct phrasal verb which is closest similar in meaning of the underlined word in the given sentence. **When Amit found out they were coming for him he <u>lit out</u> for the border.**
(a) make out (b) make over (c) make off (d) make of

4. The first and the last sentence of the passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4, and 5. These 4 parts are not arranged in proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given options.
1. There were no finger prints anywhere.
2. First of all it was impossible even for a child to enter through the hole in the roof.
3. When the investigators tried to reconstruct the crime, they came up against facts.
4. Moreover, when the detectives tried to push a silver vase, it was found to be double the size of the hole.
5. Again, the size of the hole was examined by the experts who said that nothing had been passed through it.
6. These conclusions made the detectives think that it was a fake theft.

The proper sequence should be
(a) 2, 3, 4, 5 (b) 3, 2, 4, 5 (c) 5, 3, 4, 2 (d) 3, 4, 5, 2

5. Choose the correct option based on the given statements followed by their conclusions
Statements: I. All bullets are rifles II. Some rifles are swords
Conclusions: I. Some bullets are rifles II. All swords are bullets
(a) Only conclusion I follow (b) Only conclusion II follow
(c) Either conclusion I or II follows (d) Neither conclusion I nor II follows

6. *Most of you probably did not see Mohan at close quarters. He had amazing qualities. One of these qualities was that he managed to draw out the good in another person. The other person may have had plenty of evil in him. But he somehow spotted the good and laid emphasis on the good. The result was that the poor man had to try to be good. He could not help it. He would feel ashamed when he did something wrong.* Based on the given passage, consider the following statements:
(i) The author assumes that most of us are not well-acquainted with Mohan's powers
(ii) One of Mohan's greatest qualities was that he could discover the good in another man
Which of the above statements is/are correct?
(a) Only (i) (b) Only (ii) (c) Both (i) and (ii) (d) Neither (i) nor (ii)

7. Rakhi goes 4 km West, then turns left and goes 3 km. Then, she turns right and goes 4 km and then she turns right and goes 3 km; then she turned 495^{o} towards her right and goes 5 km and finally she turned 90^{o} in clockwise direction and goes 5 km. At what distance (in km) is she from the starting point now? _____

8. What is the last digit in 2457^{754} ? _____

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9. The sum of eight consecutive odd numbers is 656. The average of four consecutive even numbers is 87. What is the sum of the smallest odd number and second largest even number? _____

10. If P and Q are running in a circular track, whose circumference is 120m, in a direction opposite to that in which R is running, who is running at twice and thrice the speed of P and Q respectively and on the same track. They start running from the same point. If P runs at the rate of 3 m/sec, when (in seconds), after the start, will Q find himself equidistant and between P and R for the first time? _____

11. If the rank of $A=[a_{ij}]_{n\times n}$ matrix is $(n-1)$, then

(a) $adj(A)=0$ (b) $adj(A)\neq 0$ (c) $adj(A)=I_n$ (d) None of these

12. The magnitude of directional derivative of $f(x,y,z)=xy^2+yz^3$ at the point $(2,-1,1)$ in the direction of vector $\mathbf{i}+2\mathbf{j}+2\mathbf{k}$ is _____.

13. If $\text{Median}=k(\text{Mode}+2\text{Mean})$, then value of k is _____.

14. In Poisson distribution, the first two frequencies are 150 and 90, then the third frequency is _____.

15. $\int_1^4 \frac{dx}{x^2-9}=$ _____

(a) $(1/6)\ln(2/7)$ (b) $\ln(2/7)$ (c) $6\ln(2/7)$ (d) None of these

16. The value of $\int_0^\infty te^{-2t}\sin t dt$ is _____.

17. A straight line and a circle of radius 'a' are given. A chord is drawn at random to this circle parallel to the given line assuming uniform distribution of angle. Expected length of the chord will be

(a) $2a$ (b) πa (c) $2a/\pi$ (d) $4a/\pi$

18. The value of $\int_C \frac{z-3}{z^2+2z+5}dz$, where C is a circle defined by $|z|=1$, is _____.

19. A fair coin is tossed 10 times, then probability of getting at most six heads will be

(a) $49/64$ (b) $51/64$ (c) $53/64$ (d) $55/64$

20. Given the boundary value problem $\frac{d}{dx}\left(x\frac{dy}{dx}\right)+ky=0$, $0<x<1$, with $y(0)=y(1)=0$. Then the solutions of the boundary value problem for $k=1$ (given by y_1) and $k=5$ (given by y_5) satisfy:

(a) $\int_0^1 y_1y_5dx=0$ (b) $\int_0^1 \frac{dy_1}{dx}\frac{dy_5}{dx}dx=0$ (c) $\int_0^1 y_1y_5dx\neq 0$ (d) $\int_0^1\left(y_1y_5+\frac{dy_1}{dx}\frac{dy_5}{dx}\right)dx=0$

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Practice Test Paper – 2

Time: 30 minutes **Max. Marks: 30**

Instructions: This test paper contains question on General Aptitude and Engineering Mathematics. In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

Marking Scheme				
Question Number	**1 to 5**	**6 to 10**	**11 to 15**	**16 to 20**
Mark(s)	**1 mark**	**2 marks**	**1 mark**	**2 marks**

1. Select which part of speech is the underlined word in the given sentence: **Open the window and let in the <u>light</u>**.
(a) an adjective (b) a noun (c) a verb (d) an adverb

2. Select the appropriate option in place of underlined part of the sentence.
According to traditional Chinese medicine, people with healthy livers <u>are said to be calm and that they possess</u> unerring judgment.
(a) are said to be calm and to possess (b) said to be calm and possessing
(c) have said to be calm and to possess (d) are said to be calm and possessive of

3. Which one of the following statements where underlined word is used correctly?
(a) The birth of her child was **<u>eminent</u>**, if not past due.
(b) There was no luggage standing by to indicate an **<u>eminent</u>** departure.
(c) She offered an abbreviated version of Sheela's **<u>eminent</u>** departure.
(d) A sweep through the barn failed to reveal any **<u>eminent</u>** births.

4. Pointing to a photograph Simran says, "This man's son's sister is my mother-in-law." How is the woman's husband related to the man in the photograph?
(a) Son-in-law (b) Brother (c) Nephew (d) Grandson

5. Arrange the given words in a meaningful sequence, and then choose the most appropriate sequence among the options provided.
1. Wall 2. Clay 3. House 4. Room 5. Bricks
(a) 3, 4, 1, 2, 5 (b) 4, 3, 1, 5, 2 (c) 3, 4, 1, 5, 2 (d) 3, 4, 5, 2, 1

6. *He dropped off to sleep. The cigarette slipped out of his mouth and burnt a great black hole in his only shirt. The smart of the burn awoke him, and he got up, cursing under his breath, and fumbled in the dark for a needle in order to sew up the hole. Otherwise his wife would see it in the morning and would nag away at him for a couple of hours. But he could not find a needle. He fell asleep again.* Which one of the following statements best sums up the meaning of the above passage?
(a) The man is extremely upset to find the shirt burnt and frantically tries to repair the damage
(b) The hole in the shirt and the wife's anticipated nagging are minor problems, the greater one is that the man cannot find a needle
(c) Neither the shirt hole nor the nagging nor the lack of a needle is of great consequence
(d) The man is terrified of his wife and dreads her discovering the burnt shirt

7. In an examination, Rajul got more marks than Suresh but not as many as Kiran. Kiran get more marks than Gaurav and Manisha. Gaurav got less marks than Suresh but his marks are not the lowest in the group. Who is the second in the descending order of marks?
(a) Kiran (b) Manisha (c) Rajul (d) Suresh

8. Suman borrowed a certain sum from Arun at a certain rate of simple interest for two years. He lent this sum to Ravi at the same rate of interest compounded annually for the same period. At the end of two years, he received ₹ 4200 as compound interest but paid ₹ 4000 only as simple interest, find the rate of interest (in %). _____.

9. The odd one in the given sequence '1, 3, 10, 21, 64, 126, 388, 777, …' is: _____.

10. Two loading machines each working 12 hours per day for 8 days handle 9000 tonnes of material with an efficiency of 90%; while 3 other loading machines at an efficiency of 80% are set to

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handle 12000 tonnes of material in 6 days. Find how many hours per day each should work? _____

11. For what value of z, the function w defined by $z = e^{-v}(-\cos u + i \sin u)$, $w = u + iv$, is not analytic?

(a) $z = 1$ (b) $z = 0$ (c) All values of z (d) No value of z

12. Half the population of a town are consumers of an item. 100 investigators are appointed to find the truth. Each investigator interviews 10 individuals. How many of them are expected to report that 3 or less of the people interviewed are consumers of an item. _____

13. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and $A^3 - 6A^2 + 11A - 10I = -kI$, then $k =$ _____.

14. Residue of $x\cos(1/x)$ at $x = 0$ is

(a) -0.5 (b) 0.5 (c) -0.75 (d) 0.75

15. A random variable X has a pdf $f(x) = \begin{cases} c(1-x^4), & |x| < 1 \\ 0, & \text{otherwise} \end{cases}$. Then $P\{|x| < 0.5\} =$ _____.

16. The equation of tangent plane to the surface $2xz^2 - 3xy - 4x = 7$ at the point $(1, -1, 2)$ is

(a) $(x-1) - (y+2) + 7(z-2) = 0$ (b) $3(x+1) + (y-1) + 6(z+1) = 0$

(c) $x - 2y + 8(z-3) = 0$ (d) $7(x-1) - 3(y+1) + 8(z-2) = 0$

17. The Eigenvalue and its corresponding Eigen vector for the matrix $A = \begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$ is

(a) $\lambda = -1$, $X = \begin{bmatrix} -12 \\ 6 \end{bmatrix}$ (b) $\lambda = -6$, $X = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$

(c) $\lambda = -6$, $X = \begin{bmatrix} -12 \\ 6 \end{bmatrix}$ (d) $\lambda = -1$, $X = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$

18. Using Taylor series method, the sum of values of $y(0.1), y(0.2), y(0.3)$, for the equation $dy/dx = x^2 + y^2$ with $y(0) = 1$, is _____.

19. Three identical dice are rolled. The probability that the same number will not appear on each of them is

(a) $1/216$ (b) $215/216$ (c) $1/108$ (d) $71/72$

20. If $F(x) = f^2\{g(x)\}$, $g(1) = 2$, $g'(1) = 3$, $f(2) = 4$, $f'(2) = 5$. Then $F'(1) =$ _____.

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Practice Test Paper – 3

Time: 30 minutes **Max. Marks: 30**

Instructions: This test paper contains question on General Aptitude and Engineering Mathematics. In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

Marking Scheme				
Question Number	**1 to 5**	**6 to 10**	**11 to 15**	**16 to 20**
Mark(s)	**1 mark**	**2 marks**	**1 mark**	**2 marks**

1. Which of the following is a grammatically CORRECT sentence?
(a) The value of Indian rupee drops since the early 1980s.
(b) The value of Indian rupee have dropped since the early 1980s.
(c) The value of Indian rupee dropping since the early 1980s.
(d) The value of Indian rupee has dropped since the early 1980s.

2. Some parts, which are labelled as P, Q, R and S, of the following sentences have been jumbled up. Choose the correct sequence to produce the correct sentence.
The focus and subsequently expand our trade with the outside and develop the cooperation
P **Q**
is to increase agriculture and industrial production of our economic construction.
R **S**
(a) RSQP (b) SRPQ (c) RSPQ (d) SRQP

3. Which one, from given options, is the most suitable 'one word substitute' for the given expression. **'One who is determined to exact full vengeance for wrong done to him'**
(a) Virulent (b) Vindictive (c) Usurer (d) Vindicator

4. If cloud is called white, white is called rain, rain is called green, green is called air, air is called Green and blue is called water, where will the birds fly?
(a) Air (b) Cloud (c) Green (d) Rain

5. Choose the best response which shall present you as a good person or a sincere professional for **"No risk no loss"**, you
(a) feel that risk means no profit
(b) believe that this statement is correct
(c) decided that in life the risk should not be taken
(d) fell that risk may be taken only after analysing the situation completely

6. *In our approach to-life, be it pragmatic or otherwise, a basic fact that confronts us squarely and unmistakably is the desire for peace, security and happiness. Different forms of life at different levels of existence make up the teeming denizens of this earth of ours. And, no matter whether they belong to the higher groups such as human beings or to the lower groups such as animals, all beings primarily seek peace, comfort and security. Life is as dear to a mute creature as it is to a man. Even the lowliest insect strives for protection against dangers that threaten its life. Just as each one of us wants to live and not to die, so do all other creatures.* The author's main point is that
(a) different forms of life are found on earth
(b) different levels of existence are possible in nature
(c) peace and security are the chief goals of all living beings
(d) even the weakest creature struggles to preserve its life

7. Two union representatives and one management representative are seated together at an octagonal table with only one seat to a side of the table. No pair of either union or management representatives may be seated together. Two additional management representatives are to be seated. Seated between the two union representatives are _____. Seated opposite of the first management representative _____.
(a) not more than one management representative; must be a management person
(b) at most 2 management representatives; must be a union person

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(c) only 2 management representatives; may be a union person
(d) 3 management representatives; may be a management person

8. A person has four iron bars whose lengths are 24 m, 36 m, 48 m, 84 m, respectively. This person wants to cut pieces of same length from each of the four bars. What is the least number of total pieces if he is to cut without any wastage? _____

9. The next term in the sequence is: 512BCD65, 343EFG50, 216HIJ37, 125KLM26, _____.
(a) 64NOP17 (b) 64PON17 (c) 49NOP15 (d) 49PON15

10. Which of the following is not true?
(a) $\log(1+x) < x$ for $x > 0$ (b) $\{x/(1+x)\} < \log(1+x)$ for $x > 0$
(c) $e^x > 1+x$ for $x > 0$ (d) $e^x < 1-x$ for $x > 0$

11. The complex number $z = x + iy$, which satisfies the equation $|(z+9i)/(z-9i)| = 1$, lies on
(a) the line $y = 9$ (b) a circle passing through the point $(0,3)$
(c) $x-$ axis (d) None of these

12. The value of $\lim_{x\to 0} \dfrac{xe^x - \log(1+x)}{x^2}$ is _____.

13. Number of heads in a single toss of a fair coin has the possible values $X = 0$ and $X = 1$, with probabilities $P(X=0) = P(X=1) = 0.5$. The variance of the distribution is _____.

14. The Laplace transform of the function $y(t)$ that satisfies the differential equation $3\dfrac{d^2y}{dt^2} + 2\dfrac{dy}{dt} + y = 1$, and initial conditions $y(0) = y'(0) = y''(0) = 0$, is
(a) $1/(3s^2+2s+1)$ (b) $1/\{s(3s^2+2s+1)\}$ (c) $1/\{s(3s^2+2s)\}$ (d) $1/(3s^2+2s)$

15. The rank of a 7×5 matrix A is 5 and the rank of 5×7 matrix B is 3. The minimum rank of the product of the two matrices A and B is _____.

16. The volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$ is _____.

17. Order and degree of the differential equation $\{1+(dy/dx)^5\}^{5/2} / \{d^2y/dx^2\}$ is, respectively,
(a) 2, 2 (b) 1, 5 (c) 5, 2 (d) None of these

18. The value of the integral $I = (1/\sqrt{8\pi})\int_0^\infty e^{-x^2/8}$ is _____.

19. Evaluate $\mathcal{L}^{-1}\{(4s-5)/(s^2-s-2)\}$.
(a) $e^{2t} + 3e^t$ (b) $e^t + 3e^{-t}$ (c) $e^{2t} + 3e^{-t}$ (d) $3e^t + 2e^{3t}$

20. Joint density function of two random variables X and Y is $f_{XY}(x,y) = 18y^2/x^3$ for all $x \in (2,\infty)$ and $y \in (0,1)$. Then $E(X) =$ _____.

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Practice Test Paper – 4

Time: 30 minutes **Max. Marks: 30**

Instructions: This test paper contains question on General Aptitude and Engineering Mathematics. In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

Marking Scheme				
Question Number	**1 to 5**	**6 to 10**	**11 to 15**	**16 to 20**
Mark(s)	**1 mark**	**2 marks**	**1 mark**	**2 marks**

1. After Rohan _____ in his notice at the office, his wife ran away with a lawyer.
(a) having handed (b) handing (c) had handed (d) was handing

2. Choose one from the given four options which the closest similar in meaning of the underlined word in the given sentence. **Given these constraints, we had no alternative but to suggest an improvised solution.**
(a) planned (b) outlined (c) prospective (d) makeshift

3. Choose the most appropriate word from the options given below to complete the following sentence: **It is impossible for a serious scholar to condone this _____ dismissal of respected theories.**
(a) **astute** (b) **cavalier** (c) **sagacious** (d) **necessary**

4. Choose the pair of give words which do not share a common similarity.
(a) Aphid : Paper (b) Moth : Wool (c) Termite : Wood (d) Locust : Plant

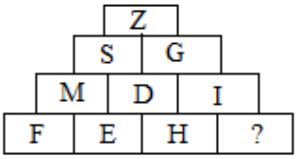
5. Choose the most appropriated option which is always associated with the given thing or word or statement. **Taj is in Agra; Agra is in India. Therefore, the Taj is in India.**
(a) Always (b) Sometimes (c) Never (d) Often

6. *One day we were becalmed among a group of small islands, most of which appeared to be uninhabited. As soon as we were in want of fresh water, the captain sent the boat ashore to bring off a cask or two. But we were mistaken in thinking there were no natives, for scarcely had we drawn near to the shore 'when a band of savages rushed out of the bush and assembled on the beach, brandishing their clubs and spears in a threatening manner.* Consider the following statements based on the above passage:
(i) The captain sent the boat to the shore to fetch some water
(ii) The savages brandished their spears in order to frighten the crew
(iii) The inhabitants of the islands were cruel people
Which of the above statements is/are correct?
(a) Only (i) (b) Only (iii) (c) Both (i) and (ii) (d) Both (ii) and (iii)

7. Professor Pant is forming five-person special group for his project. The group must contain one team-leader, two computer engineers and two electrical engineers. P, Q and R are possible computer engineers. R, S and T are possible team-leaders. U, V and W are possible electrical engineers. Also, P and R prefers to work with each other in the same team. T prefers to work only if V works. How many different possible groups, Professor Pant can make? _____.

8. Consider the following statement: (i) The ratio between Amit's present age and his age after 8 years $4:5$; (ii) The ratio between the present ages of Amit and Divya is $4:3$; (iii) The ratio between Divya's present age and his age four years ago is $6:5$. To find the difference between the present ages of Amit and Divya, which of the following option is correct?
(a) (i) or (iii) only (b) Any one of the three
(c) Any two of (i), (ii) and (iii) (d) All (i), (ii) and (iii) are required

9. The missing character in the given figure is
(a) L (b) B (c) D (d) G



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10. $f(x)=\sin^2 x+\sin^2\left(x+(\pi/3)\right)+\cos x\cos\left(x+(\pi/3)\right)$ *and* $g(5/4)=1$, then $(gof)(x)=$_____

11. The value of line integral $\int_C (ydx+zdy+xdz)$, where C is the curve of intersection of $x^2+y^2+z^2=a^2$ and $x+z=a$, is

(a) $\pi a^2/\sqrt{2}$ (b) $-\pi a^2/\sqrt{2}$ (c) $-\pi a^2/\sqrt{3}$ (d) $\pi a^2/\sqrt{3}$

12. The sum and product of eigenvalues of the matrix $A=\begin{bmatrix}1 & 3 & 7\\ 2 & -1 & 1\\ 0 & 5 & 4\end{bmatrix}$ are, respectively,

(a) 4 and 37 (b) 6 and 32 (c) 6 and 37 (d) 4 and 32

13. The solution of the differential equation $\frac{d^3y}{dx^3}+\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=0$ is

(a) $y=A\cos 2x+B\sin 2x$ (b) $y=Ae^{-x}+B\cos 2x+C\sin 2x$

(c) $y=Ae^{x}+B\cos 2x+C\sin 2x$ (d) $y=Ae^{-2x}+B\cos 2x+C\sin 2x$

14. Equation of two regression lines are $y=2x+3$, $x+0.8y=4$, then correlation coefficient is _____.

15. A box contains 6 red, 4 white, 5 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn there is at least one ball of each colour. _____

16. For what values of λ and μ, does the system of equations: $2x+3y+5z=9$, $7x+3y-2z=8$, $2x+3y+\lambda z=\mu$, have infinite number of solutions?

(a) $\lambda=5,\ \mu=9$ (b) $\lambda\neq 5,\ \mu=9$ (c) $\lambda=5,\ \mu\neq 9$ (d) $\lambda\neq 5,\ \mu\neq 9$

17. If standard deviation of two variables X and Y are 5 and 6, respectively, and their covariance is 12, then coefficient of correlation between X and Y is _____.

18. If $y(-1)=5$, $y(1)=8$, then using Newton's central difference scheme, the value of $(dy/dx)_{x=0}$ is _____.

19. Let $f(x)$ be the function of period $2T=2$ which is given on the interval $(-1,1)$ by $f(x)=1-x^2$, the Fourier series of $f(x)$ is

(a) $f(x)=\frac{2}{3}-\frac{4}{\pi^2}\sum_{n=1}^{\infty}\frac{\cos(n\pi x)}{n^2}$ (b) $f(x)=\frac{2}{3}+\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^2}\cos(n\pi x)$

(c) $f(x)=\frac{2}{3}+\frac{4}{\pi^2}\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^2}\cos(n\pi x)$ (d) $f(x)=\frac{2}{3}+\frac{4}{\pi^2}\sum_{n=1}^{\infty}\frac{(-1)^{n}}{n^2}\cos(n\pi x)$

20. The distance between the origin and the point nearest to it on the surface $z^2=1+xy$ is _____.

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Practice Test Paper – 5

Time: 30 minutes **Max. Marks: 30**

Instructions: This test paper contains question on General Aptitude and Engineering Mathematics. In all the following questions choose the correct option wherever option is given; fill the calculated value, at the appropriate place, wherever it is asked to fill.

Marking Scheme				
Question Number	**1 to 5**	**6 to 10**	**11 to 15**	**16 to 20**
Mark(s)	**1 mark**	**2 marks**	**1 mark**	**2 marks**

1. Which one of the following is grammatically INCORRECT sentence?
(a) I was invited, but I declined the invitation.
(b) Have you ever read the book From Sex to Superconsciousness?
(c) Javed Akhtar, a famous poet, has recently directed a movie.
(d) Rainbows are arcs showed the colours of the spectrum, violet inside and red outside.

2. Choose one from the given four options which the closest opposite in meaning of **Gumption**.
(a) Seriousness (b) Apathy (c) Levity (d) Despair

3. Select the pair (from the given four options) that best expresses a relationship similar to that expressed in the given pair. **Farewell : Valediction**
(a) Oration : Prediction (b) Fiat : Condescension
(c) Praise : Panegyric (d) Stutter : Hesitation

4. The first and the last sentence of the passage are in order and numbered 1 and 6. The rest of the passage is split into 4 parts and numbered as 2, 3, 4, and 5. These 4 parts are not arranged in proper order. Read the sentences and arrange them in a logical sequence to make a passage and choose the correct sequence from the given options.
1. For years the old chair stood in one of the empty antics.
2. So when I saw it for the last time, it stood there.
3. When my mother died, I wanted to sell it but could not.
4. It was there for many years after my father died.
5. I peeped in the past.
6. I saw my parents madly in love again.

The proper sequence should be
(a) 2, 3, 4, 5 (b) 5, 4, 3, 2 (c) 4, 2, 3, 5 (d) 4, 3, 2, 5

5. Consider the statement and the following assumptions, decide which of the assumptions is implicit in the statement and choose the correct option from the given options.
Statement: The chairman and secretary of the housing society have requested society members to use water economically to help society to save on water-tax.
Assumptions I: Majority of members of the society are likely to follow the request.
Assumptions II: It is desirable to reduce expenditure whenever possible.
(a) Only assumption I is implicit (b) Only assumption II is implicit
(c) Both assumptions I and II are implicit (d) Neither assumption I nor II is implicit

6. *Human ways of life have steadily changed. About ten thousand years ago, man lived entirely by hunting. A settled civilized life began only when agriculture was discovered. From that time to this, civilization has always been changing. Ancient Egypt-Greece-the Roman Empire-the Dark Ages and the Middle Ages-the Renaissance-the age of modern science and of modern nations-one has succeeded the other, and history has never stood still. Even if we try to do nothing, we cannot prevent change.* The subject of the given passage is
(a) the revolutionary process of the growth of mankind
(b) the biological evolution of mankind
(c) the revolutionary process of growth of civilization
(d) the dialectic process of civilization

7. In an examination, three problems A, B and C were posed. Among the students there were 25 who solved at least one problem each. Of all the students who did not solve problem A, the number

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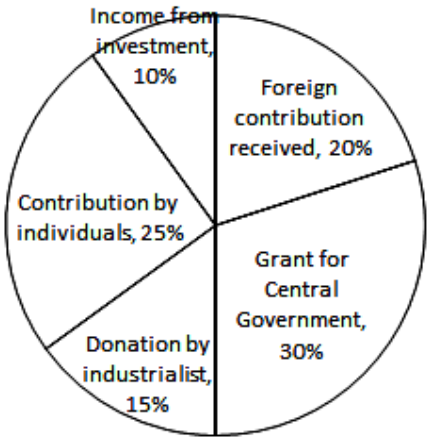
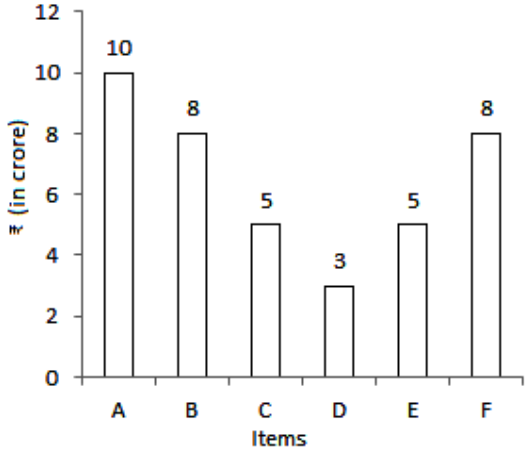
who solved B was twice the number who solved C. The number of participants, who solved only problem A, was one more than the number who solved problem A and at least one other problem. Of all students who solved just one problem, half did not solve problem A. How many students solved only problem B? _____

8. Three containers P, Q and R are having mixtures of water and milk in the ratio $5:1$, $5:3$ and $7:5$, respectively. If the capacities of the containers are in the ratio $5:4:5$, then find the ratio of the milk to the water if the mixtures of all the three containers are mixed together.
(a) $115:53$ (b) $115:54$ (c) $54:115$ (d) $53:115$

9. Two cars one moving towards South and the other towards West, leave the same place at the same time. The speed of one of them is greater than that of the other by 5 km/h. At the end of two hours, they are at a distance of 50 km from each other. What is the speed (in km/h) of the bus going slower? _____

10. The pie chart shows sources of income for an NGO. The total income is ₹ 40 crore. The bar chart gives the expenditure incurred on various items: A – Food for poor; B – Education of illiterate; C – Mid day meal programme; E – Eye camp expenses; F – Integrated street children programme. Total expenditure is ₹ 39 crore.


Income from investment, 10%
Foreign contribution received, 20%
Contribution by individuals, 25%
Grant for Central Government, 30%
Donation by industrialist, 15%



Suppose in a particular year, grant from Central Government increases by 10%, foreign contribution decrease by 10% and other income amounts remain same. If the expenses pattern remains same, what is the percentage (in %) increase in 'Food for poor' sector? _____

11. The value of λ for which the system of equation $x+y+z=6$, $4x+\lambda y-\lambda z=0$, $3x+2y-4z=-8$, have no solution, is _____.

12. The value of $\lim_{x\to 0} x\ln(\sin x)$ is _____.

13. Possible solution for the differential equation $\dot{y}(t)+2y(t)=u(t)$ with initial condition $y(0^-)=0$ is
(a) $e^{-2t}u(t)$ (b) $(1/2)e^{-2t}u(t)$ (c) $(1/2)(1-e^{-2t})u(t)$ (d) $(1-e^{-2t})u(t)$

14. Let $f(z)=u(x,y)+iv(x,y)$, where $z=x+iy$. If $u(x,y)=x^2-y^2+2xy$. Then $f(z)$ can be expressed as
(a) $2z^2/(1+i)$ (b) $2z^2/(1-i)$ (c) z^2+iz^{-2} (d) $(1+i)z^2$

15. Consider two random variables X and Y such that $E(X^2)=E(Y^2)$ with zero mean. Two other random variables are created: $W_1=X+Y$ and $W_2=X-Y$. The coefficient of correlation between W_1 and W_2 is _____.

16. The stationary point for the given function $f(x,y)=x^3+y^3-3axy$ are
(a) $(0,1),(1,a)$ (b) $(0,0),(a,a)$ (c) $(0,a),(1,a)$ (d) None of these

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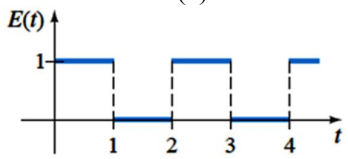
17. If the vertices of a triangle are $A(0,0)$, $A(1,0)$, $C(0,1)$. Find the value of the integral $\iint 2xdxdy$ over the triangle is _____.

18. Evaluate $\int_C \frac{2z^2+1}{(z+1)2(z-2)}dz$, where C is the circle $|z|=3$.

(a) πi (b) $2\pi i$ (c) $3\pi i$ (d) $4\pi i$

19. The Laplace transform of the periodic function (square wave) shown in figure is



(a) $1/\{s(1+e^{s})\}$ (b) $1/\{s(1-e^{-s})\}$

(c) $1/\{s(1+e^{-s})\}$ (d) $1/(1+e^{-s})$

20. Which of the following improper integrals is convergent?

(a) $\int_0^1 \frac{\sin x}{1-\cos x}dx$ (b) $\int_1^\infty \frac{1+3\sin^4(2x)}{\sqrt{x}}dx$ (c) $\int_0^\infty \frac{x}{1+x^2}dx$ (d) $\int_0^1 \frac{2(1-\cos x)}{x^{5/2}}dx$

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Practice Test Paper Answer Keys

Answer Keys: Practice Test Paper – 1

1	2	3	4	5	6	7	8	9	10
d	a	c	b	d	c	15	9	163	17.14
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	3.67	0.34	5.4	d	0.16	d	0	d	a

Answer Keys: Practice Test Paper – 2

1	2	3	4	5	6	7	8	9	10
b	a	c	d	c	c	c	10	126	16
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	17	4	a	0.617	d	c	3.788	b	120

Answer Keys: Practice Test Paper – 3

1	2	3	4	5	6	7	8	9	10
d	b	b	c	d	c	a	16	a	d
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	1.5	0.25	b	3	50.26	a	0.5	c	3

Answer Keys: Practice Test Paper – 4

1	2	3	4	5	6	7	8	9	10
c	d	b	a	a	c	8	c	d	1
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	a	b	0.79	0.527	a	0.4	1.5	c	1

Answer Keys: Practice Test Paper – 5

1	2	3	4	5	6	7	8	9	10
d	b	c	d	c	c	6	d	15	1
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
3	0	c	a	0	b	0.33	d	c	d

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